

# SUPPLEMENT.

## The Mining Journal, RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

[The MINING JOURNAL is Registered at the General Post Office as a Newspaper, and for Transmission Abroad.]

No. 2556.—VOL. LIV.

LONDON, SATURDAY, AUGUST 16, 1884.

PRICE (WITH THE JOURNAL) SIXPENCE  
BY POST £1 4s. PER ANNUM.

SILVER MEDAL, ROYAL CORNWALL POLYTECHNIC  
Highest Award for Effectiveness in Boring, and Economy in  
the Consumption of Air.

JUBILEE EXHIBITION, 1882.

THE PATENT

### "CORNISH" ROCK DRILL.

FIRST  
SILVER  
MEDAL,  
MINING  
INSTITUTE  
OF  
CORNWALL.



FIRST  
AWARD  
BORING  
CONTEST  
DOLCOATH  
MINE,  
DECEMBER,  
1881.

Prices and particulars on application to the Manufacturers,  
**HOLMAN BROTHERS,**  
CAMBORNE FOUNDRY AND ENGINE WORKS,  
CAMBORNE, CORNWALL.

GINES, AIR COMPRESSORS, TUNNELLING  
CARRIAGES, TRIPODS, &c.,  
From own design, or to order.

### PATENT "INGERSOLL ROCK DRILL."

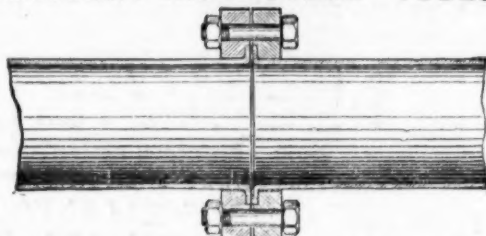
MEDAL  
AND  
HIGHEST  
AWARDS.

1872—American  
Institute.  
1873—Ditto.  
1874—London  
International.  
1875—Manchester.  
1875—Leeds.  
1875—Cornwall.  
1875—Rio de Janeiro.  
1876—Australia.  
1876—Philadelphia.  
1877—Cornwall.  
1877—Mining Institute.  
1878—Paris.



We claim 40 per  
cent. greater effective  
drilling  
power.

### WROUGHT-IRON STEAM TUBES.



TUBES FOR BOILERS, PERKINS'S, and other HOT-WATER SYSTEMS.

For Catalogues of Rock Drills, Air Compressors, Steel or Iron Steam Tubing  
Boiler Tubes, Perkins's Tubes, Pneumatic Tubes, and all kinds of Machinery and  
MINING PLANT, apply to—

**LE GROS, MAYNE, LEAVER & CO.**  
60, Queen Victoria Street, London, E.C.

### ROCK DRILLS FOR HAND AND POWER.



**DUNCAN BROS.,**  
32, QUEEN VICTORIA STREET,  
LONDON, E.C.

**STEPHEN DAVISON,**  
TIMBER AND MINING STORES MERCHANT,  
MORPETH.

Chocks, Sleepers, Shafts, Helves, Spokes, Naves, Felloes, Pit Props,  
Mining Timber, Tub-wood, Wagon-wood, &c., supplied at  
Market Value.  
MINES BOUGHT. COMPANIES FORMED ON EQUITABLE  
TERMS.

**MORDEY, CARNEY, AND CO. (LIMITED),**  
SHIPBUILDERS, AND MARINE AND GENERAL  
ENGINEERING WORKS,  
DRY DOCKS, NEWPORT, MON.

All kinds of WROUGHT and CAST IRON STRUCTURAL WORK,  
including Girders, Tanks, Boilers, Colliery Plant, Winding Engines,  
Iron Coal Wagons, heavy Smith Forgings, Dock Gates and Caisons,  
and requirements of Harbour and Dock Works, &c., &c.  
All Orders executed promptly, and Tenders from Plans  
and Specifications.

### AIR COMPRESSORS,



With R. SCHRAM'S  
Patent

Inlet and Outlet Valves.  
**BOILERS, TURBINES.**

SCHRAM'S IMPROVED

### ROCK DRILL.

1600 in Use in all Parts of the World.

Complete Rock Boring Plants of the most  
approved construction for Railway Tunnels,  
Quarries, Shaft Sinking, Level Driving,  
Stoping, and Submarine Blasting.

### All Kinds of Mining Machinery.

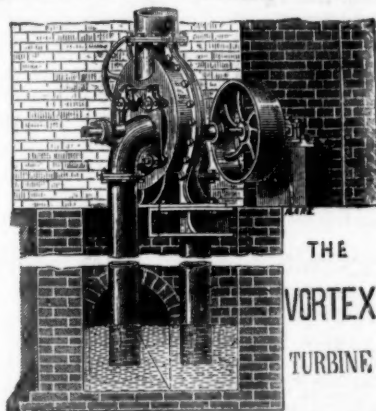
ESTIMATES AND FULL PARTICULARS ON APPLICATION.

**RICHARD SCHRAM & CO.,**  
9, NORTHUMBERLAND STREET, CHARING CROSS,  
LONDON.

### GILBERT GILKES & CO.,

KENDAL, ENGLAND,  
LATE

### WILLIAMSON BROS.



THE  
VORTEX  
TURBINE

A most efficient means of applying Water Power to all kinds of  
Machinery.

Largely used in DRIVING AIR COMPRESSORS, PUMPING,  
WORKING ORE-CRUSHING MACHINERY, and for other pur-  
poses in connection with MINING.  
Successfully used in ELECTRIC LIGHTING, and in utilising  
DISTANT WATER POWER by means of ELECTRICITY.

A Pamphlet containing a full description of the Vortex, with se-  
veral Illustrations and a number of Testimonials, can be obtained on  
application.

### "THE PATENT ACCESSIBLE" CENTRIFUGAL PUMP

Is the only Pump from which the disc can be removed by  
breaking the joint on a single face only.

Manufactured by **CHARLES L. HETT,**

HYDRAULIC ENGINEER,

Maker of

IMPROVED CENTRE VENT

TURBIN

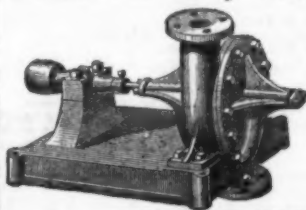
WATER WHEELS,

Horse, Steam and Wind Power

PUMPS

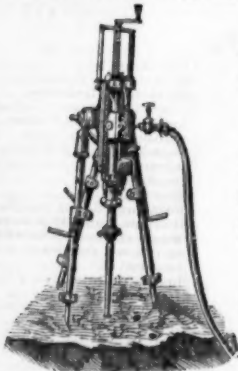
Catalogues on Application.

**ANCHOLME FOUNDRY, BRIGG,**  
ENGLAND.



### THE PATENT "ECLIPSE" ROCK-DRILL AND "RELIANCE AIR-COMPRESSOR."

Silver Medal awarded at Boring Competition, East Pool Mine, Sept. 1883.



Are NOW SUPPLIED to the  
ENGLISH, FOREIGN, and  
COLONIAL GOVERN-  
MENTS, and are also IN USE  
in a number of the largest  
MINES, RAILWAYS, QUAR-  
RIES, and HARBOUR  
WORKS in GREAT BRITAIN  
and ABROAD.

FOR ILLUSTRATED CATALOGUE AND PRICES, apply to—  
**HATHORN & CO., 22, Charing Cross, London, S.W.**

**S. MASON and Co.,**  
STONE MACHINE WORKS, LEICESTER.

### New Patent Simplex Stone Breaker.

Patented June, 1884.

This Machine only has five wearing parts; others have 20.  
LARGE SIZES.

Can be worked by hand or cattle Power.

IT HAS 24 ADVANTAGES OVER ALL OTHERS.

SEND FOR LISTS OF OUR OTHER PATENTS; ALSO  
RECENT TESTIMONIALS



# BELL'S ASBESTOS.

**BELL'S PATENT ASBESTOS BLOCK PACKING for High-Pressure Engines.**

The following testimonials refer to this Packing:—

Mona Lodge, Amlwich, Anglesey,

2nd August, 1884.

DEAR SIR,—I have much pleasure in answering your note. Bad times in mining have compelled me to try all kinds of expedients in order to effect saving; some have succeeded and some have failed, but my underground manager, Capt. Hughes, has just said to me by the telephone—"The Asbestos Packing is the best thing ever brought here."

It saves money and trouble, but like my gas purifying oxide it lasts so long that you must not expect another order from me for twelve months at least.

Yours truly,

Mr. J. Bell.

Late H.M. Inspector of Metalliferous Mines.  
Manchester, Sheffield, and Lincolnshire Railway—Steamship Department,  
Grimsby, April 10th, 1884.

DEAR SIR,—I have much pleasure in stating that after a trial of over nine months, and comparing it with other packings, I can confidently recommend your Asbestos Packing. It is especially valuable when high-pressures are employed, as in cases where other packings have perished, owing to high temperatures, your packing has invariably stood well. I have also used it with complete success when a gland has heated with other packings, and also in cases of badly scored piston rods. I consider the results I have obtained by its use for our marine engines to have been in every way highly satisfactory.

Yours truly,

Mr. J. Bell.

G. H. CLARKE, Sup. Engineer.  
Department of the Director of Navy Contracts,  
Admiralty, Whitehall, 20th June, 1884.

SIR,—I have to inform you that your tender has been accepted for Bell's Rolled Cloth Asbestos Packing to sample submitted:—Elastic core ... Square ... Round.

To Mr. John Bell.

The Patent Block Packing is square, as Fig. 1 and Figs. 2 and 3 represent the Round Block Packing with solid and hollow rubber core, and Fig. 4 without core, but with rubber inlay. As these packings are extensively imitated, and as it is a common practice among dealers and agents to supply the cheaper manufactures at my list prices, users are requested to see that the packing supplied to them bears the trade mark.

**BELL'S ASBESTOS BOILER PRESERVATIVE.**—This useful mixture by absorbing the free oxygen that is in the water entirely checks pitting and corrosion. It also disintegrates incrustation so immediately as to prevent its adhering to the plates. Not only is a great economy of fuel effected by keeping boilers clean, but the risk of having the plates burned is thereby obviated. It has been computed that  $\frac{1}{4}$  in. thick of incrustation causes a waste of 15 per cent. of coal;  $\frac{3}{4}$  in., 60 per cent.;  $\frac{1}{2}$  in., 150 per cent. Thus the Preservative avoids the great risks which are inseparable from scaled plates, lengthens the life of a boiler, and covers its own cost a hundred-fold by economy of fuel. It is entirely harmless, and has no injurious action on metals. It can be put into the feed tank or boiler, as may be most convenient. Sold in drums and casks bearing the Trade Mark, without which none is genuine.

**BELL'S ASBESTOS YARN and SOAPSTONE PACKING** for Locomotives and all Stationary Engines running at very high speed with intense friction. Sandwell Park Colliery, Smethwick, 1st February, 1884.

To Bell's Asbestos Works.

DEAR SIR,—I have much pleasure in stating that I have used your Asbestos Packing for the last 13 months for our large winding engines which are running night and day, and also for the fan, pumping, and hauling engines at the above Colliery, and during that period we have not used more than one-third the Packing we had formerly; and this I attribute to your Packing on account of its great durability and general excellence of quality.—I am, dear Sir, yours faithfully,

THOMAS WINTER, Colliery Engineer.



TRADE MARK.

**BELL'S ASBESTOS.**

The goods of this house are of the highest quality only, and no attempt is made to compete with other manufacturers by the supply of inferior materials at low prices. All "home" orders should be sent direct to the undermentioned depots and not through Agents or Factors.

**BELL'S ASBESTOS BOILER and PIPE COVERING COMPOSITION.** coating every class of steam pipes and boilers, non-combustible and easily applied when cold; is up; adheres to metals and preserves them from rust; prevents the unequal expansion and contraction of boilers exposed to weather; covers 50 per cent. more surface than any other coating and is absolutely indestructible. It can be stripped off after many years' use, mixed up with water to the consistency required for use.

A Horizontal Boiler, 17 ft. 6 in. long, 15-H.P., gave the following results:—

Temperature on Plates ... 196 deg.  
Covering ... 94 deg.

One ton of coal was saved per week, and although the fire was raked out every evening 20 lbs. of steam were found in the boiler next morning.

The following Testimonials refer to this Covering:—

DEAR SIR,—It may interest you to know that we have exactly 48 per cent. in fuel savings using your covering.

Office of the Wimbledon Local Board, Wimbledon, Nov. 23rd, 1884.

Yours truly, W. SANTO CRIMP, C.E., F.G.S.

The Tamar and Kit Hill Granite Company (Limited),

Mr. John Bell, Southwark, S.E.

SIR,—I have much pleasure in stating that the Asbestos covering applied by you to the

of our travelling crane at Kit Hill has yielded most remarkable results. Since it has been

we have saved fully half our coals, and have effected a great saving in the time it takes to

steam, which is often a matter of great importance to us. I should add that the crane

high gentries, and is fully exposed to all weather. I have formed the highest opinion of

Asbestos as used for this purpose, and as you are aware, have had another boiler similarly covered

though it has not since been used. I can most strongly recommend the material.

I am, Sir, yours faithfully, W. J. CHALK, Assoc. M. Inst. C.E., Engineer and Manager

**BELL'S ASBESTOS and INDIA-RUBBER WOVEN SHEETING.** TAPE

for making every class of Steam and Water Joints. It can be

hand to the form required without puckering, and is especially useful in

joints of manhole and mudhole doors. It is kept in stock in rolls of 100 ft.,

$\frac{1}{2}$  in. to 3 in. wide, and any thickness from  $\frac{1}{16}$  in. upwards. Manhole covers

lifted many times before the renewal of the jointing material is necessary. The

material is made up into sheets about 40 in. square, and each sheet bears the Trade

without which none is genuine. It is very necessary to guard against imitations

this useful material, and to secure themselves against being supplied with

inferior articles at my price, users are recommended to see that every 10 ft. length

of the Asbestos Tape purchased by them bears the Trade Mark.

**BELL'S SPECIAL LONDON-MADE ASBESTOS MILLBOARD**

for Dry Steam Joints, made of the best Asbestos fibre, is well-known for its toughness

and purity, and is absolutely free from the injurious ingredients frequently

attain an appearance of finish, regardless of the real utility of the material. Made

sheets measuring about 40 in. square, from  $\frac{1}{16}$  in. to 1 in., and  $\frac{1}{2}$  millimetres

25 millimetres thick. Each sheet bears the Trade Mark.

The following copy of acceptance of tender refers to above:—

Department of the Director of Navy Contracts.

SIR,—I have to inform you that your tender for Asbestos Millboard has been

accepted.—Mr. John Bell.

Admiralty, Whitehall, S.W., 17th May, 1884.

JOHN COLLETT, Director of Navy Contracts.

**BELL'S ASBESTOS EXPANSION SHEETING (PATENT).**

Sheeting is another combination of Asbestos with India-rubber, giving to the

user the special advantages of both materials. The India-rubber Washer is

from the action of heat and grease by an outer coating of vulcanised Asbestos

thus producing an excellent joint where expansion and contraction render

materials unserviceable. This material is admirably suited to steam pipe joints

every class of valve. Valves made of this material are very durable, as they are

subject to injury by oil.

## BELL'S "ASBESTOS LUBRICANT."

REGD

ILLUSTRATED PRICED CATALOGUE FREE ON APPLICATION TO

**BELL'S ASBESTOS WORKS, SOUTHWARK, LONDON, S. E.**

OR THE DEPOTS—118a, SOUTHWARK STREET, S.E.,

Victoria Buildings, Deansgate, MANCHESTER.

11 and 13, St. Vincent Place, GLASGOW.

39, Mount Stuart Square, CARDIFF.

21, Ritter Strasse, BERLIN.

## R. S. NEWALL AND CO.,

Sole Patentees of Untwisted Wire Rope.

**Iron & Steel Ropes of the highest quality for Collieries,  
Railways, Suspension Bridges, &c.**

PATENT STEEL FLEXIBLE ROPES AND HAWSERS.

IRON STEEL, AND COPPER CORDS.

LIGHTNING CONDUCTORS.

COPPER CABLES of high Conductivity for Electric Light and Power.

London: 130, STRAND, W.C.

Liverpool: 7, NEW QUAY.

Glasgow: 69, ANDERSTON QUAY.

MANUFACTORY: GATESHEAD-ON-TYNE.

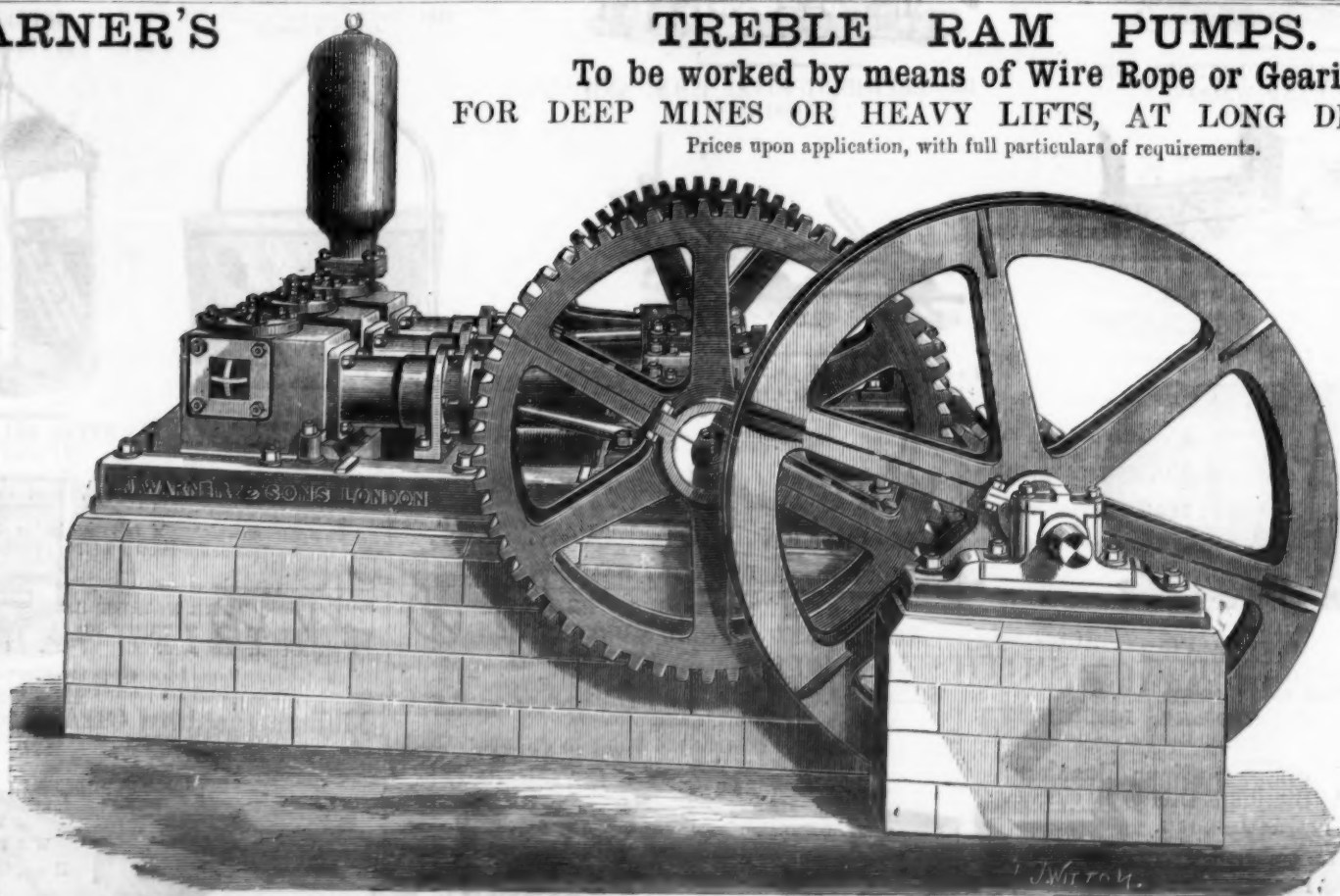
## WARNER'S

## TREBLE RAM PUMPS.

To be worked by means of Wire Rope or Gearing.

FOR DEEP MINES OR HEAVY LIFTS, AT LONG DISTANCES.

Prices upon application, with full particulars of requirements.



As supplied to Messrs BOWES, of Springwell Colliery, Gateshead, for a Lift of (600) Six hundred feet vertical through two miles of pipes.

**JOHN WARNER AND SONS, THE CRESCENT FOUNDRY, CRIPPLEGATE,  
LONDON, E.C.**



# R. HUDSON'S Patent Steel Trucks, Points and Crossings, PORTABLE RAILWAY, STEEL BUCKETS, &c., &c.

Telephone No. 14.  
In connection with the  
Leeds Exchange, and all  
the principal Hotels and  
places of business in the  
town.

## GILDERSOME FOUNDRY, NEAR LEEDS.

(Near Gildersome Station, G.N.R. Main Line, Bradford to Wakefield and London,  
via Laisterdyke and Ardsley Junctions.)

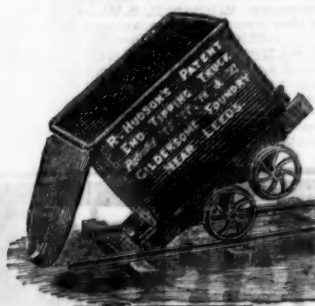
Registered  
Telegraphic Address:-  
"GILDERSOME,  
LEEDS."  
A. B. C. Code used.

UPWARDS of 25,000 of these Trucks and Wagons have been supplied to the South African Diamond Mines; American, Spanish, Indian, and Welsh Gold, Silver, Copper, and Lead Mines; Indian and Brazilian Railways, and to Railway Contractors, Chemical Works, Brick Works, and Coal and Mineral Shippers, &c., &c., and can be made to lift off the underwork, to let down into the hold of a vessel, and easily replaced. They are also largely used in the Coal and other Mines in this country, and are the **LIGHTEST, STRONGEST, and most CAPACIOUS** made, infinitely stronger and lighter than wooden ones, and are all fitted with R. H.'s Patent "Rim" round top of wagons, requiring no rivets, and giving immense strength and rigidity. End and body plates are also joined on R. H.'s patent method, dispensing with angle-irons or corner plates.

Patented in Europe, America, Australia, India, and British South Africa, 1875, 1877, 1878, 1881, and 1883.  
N.B:-The American, Australian, Indian, and Spanish Patents on Sale.

### CAN BE MADE TO ANY SIZE, AND TO ANY GAUGE OF RAILS.

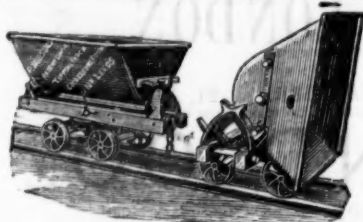
1.-PATENT STEEL END  
TIP WAGONS.



7.-PATENT STEEL MINING WAGONS.



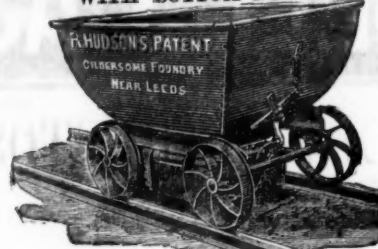
2.-PATENT UNIVERSAL TRIPLE-CENTRE  
STEEL TIPPING TRUCK,  
Will tip either side or either end of rails.



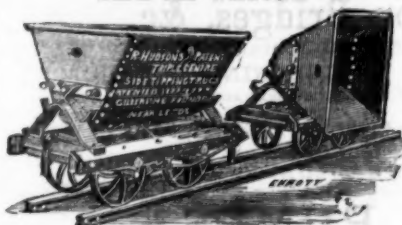
8.-PATENT DOUBLE-CENTRE STEEL  
SIDE TIP WAGONS,  
Will tip either side of Wagons.



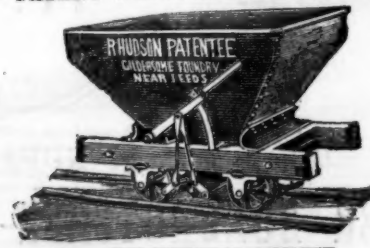
12.-PATENT STEEL HOPPER WAGON,  
WITH BOTTOM DOORS.



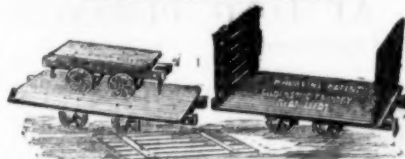
3.-PATENT TRIPLE-CENTRE STEEL  
SIDE TIP WAGONS.



13.-PATENT STEEL HOPPER WAGON.



4.-PATENT STEEL PLATFORM OR  
SUGAR CANE WAGON.



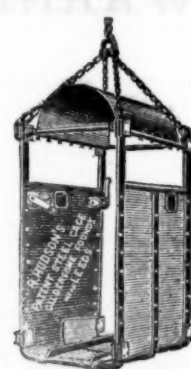
9.-PATENT STEEL ALL-ROUND TIP  
WAGON.



14.-SELF-RIGHTING STEEL  
TIP BUCKET.  
(The "CATCH" can also be made SELF-  
ACTING if desired.)



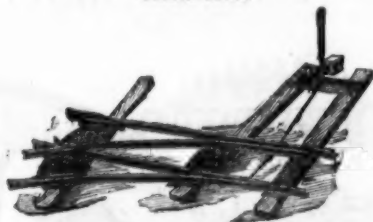
15.-STEEL CAGE.



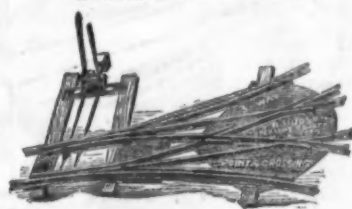
5.-PATENT STEEL CASK.  
As supplied to H.M. War Office for the late war in Egypt.  
DOUBLE the STRENGTH of ordinary Casks without any  
INCREASE in weight.  
(Made from 10 gals. capacity UPWARDS to any desired size.)



10.-LEFT-HAND STEEL POINT AND  
CROSSING.



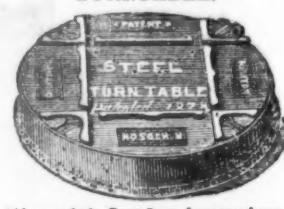
11.-RIGHT AND LEFT-HAND STEEL  
POINT AND CROSSING.



16.-PATENT STEEL WHEELBARROWS.  
Made to any Size.  
Lightest and Strongest in the Market.

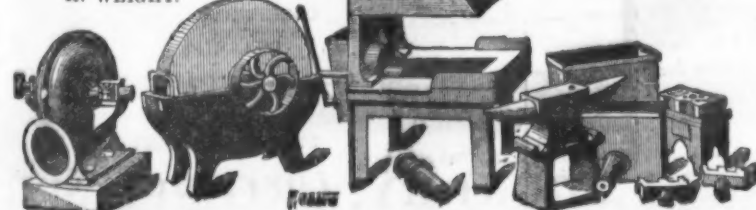


17.-STEEL SELF-CONTAINED  
TURNABLE.



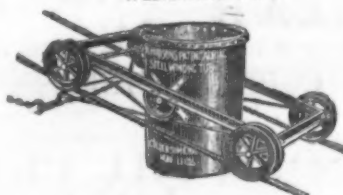
6.-ROBERT HUDSON'S  
PATENT IMPROVED IRON  
SMITH'S HEARTH,  
NO BRICKWORK REQUIRED.

A Special quality made almost entirely  
in STEEL, effecting a GREAT SAVING  
IN WEIGHT.



Large numbers in use by all the principal Engineers in this  
country and abroad.

18.-"AERIAL" STEEL  
WINDING TUB.



Largely employed in the South African  
Diamond Fields.

NO. 19.-PATENT STEEL CHARGING BARROW,  
DOUBLE the STRENGTH & much LIGHTER than ordinary Barrow



ALL KINDS OF BOLTS NUTS, AND RIVETS MADE TO ORDER ON THE PREMISES



Pumping Engines  
for  
Mines, Water Works,  
Sewage Works,  
and  
General Purposes.  
CATALOGUES ON

# PUMPING & MINING MACHINERY. HATHORN, DAVEY, & CO., LEEDS.

Hydraulic Pumps,  
Winding Engines,  
Air Compressors,  
Man Engines,  
Capstans,  
&c., &c.  
APPLICATION.

## DEUTSCHE SPRENGSTOFF ACT.-GES.



(GERMAN EXPLOSIVES COMPANY, LIMITED),  
HAMBURG.

## DYNAMITE

Of the HIGHEST DESCRIPTION, and of the maximum strength allowed by the British Explosives Act (75 per cent. Nitroglycerine).

HEAD OFFICE: HAMBURG, PLAN, 9.

LONDON AGENT: MR. WM. BRODERSEN, 79, LEADENHALL STREET, E.C.

SHIPMENTS EFFECTED TO ALL PARTS. STOCK KEPT IN LONDON AND NUMEROUS COUNTRY MAGAZINES.

## GEORGE EGESTORFF'S DETONATORS

UNRIVALLED

IN

QUALITY.



FIRST PRIZE

MELBOURNE

1880.

MANUFACTURED BY

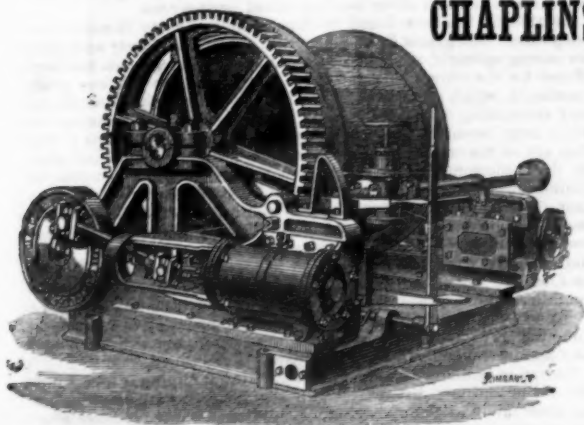
LINDENER ZÜNDHÜTCHEN- UND THONWAAREN-FABRIK  
LINDEN, NEAR HANOVER, GERMANY.

Shipments from Stock on Hand in THE THAMES, also from HAMBURG or ANTWERP.

Sole Agent:—

C. G. MUELLER, 32, St. James' Street, LONDON, S.W.,

TO WHOM ALL ORDERS SHOULD BE ADDRESSED.



## CHAPLINS' IMPROVED WINDING ENGINES

With or without Boilers, specially adapted for Pit Sinking and other Hauling and Hoisting Purposes.

Leading sizes from 10 to 26 horse-power nominal.

## PORTABLE WINDING ENGINES

On Carriage and Wheels,

With One or Two Drums, suited for Pit Sinking, &c.

Improved STEAM EXCAVATOR or "NAVY" STEAM CRANES, HOISTS, PUMPING ENGINES, LOCOMOTIVES, STEAM ROAD ROLLERS, and other of our CHAPLINS' PATENT STEAM ENGINES and BOILERS always in stock or in progress.

PATENTERS AND SOLE MANUFACTURERS,

ALEX. CHAPLIN & CO.,

CRANSTONHILL ENGINE WORKS, GLASGOW.

63, Queen Victoria-street, London, E.C.

## MANCHESTER WIRE WORKS.

NEAR VICTORIA STATION, MANCHESTER.

(ESTABLISHED 1790).

## JOHN STANIAR AND CO.,

Manufacturers by STEAM POWER of all kinds of Wire Web, EXTRA TREBLE STRONG for LEAD AND COPPER MINES.

Jigger Bottoms and Cylinder Covers woven ANY WIDTH, in Iron, Steel, Brass, or Copper.

EXTRA STRONG PERFORATED ZINC AND COPPER RIDDLES AND SIEVES.

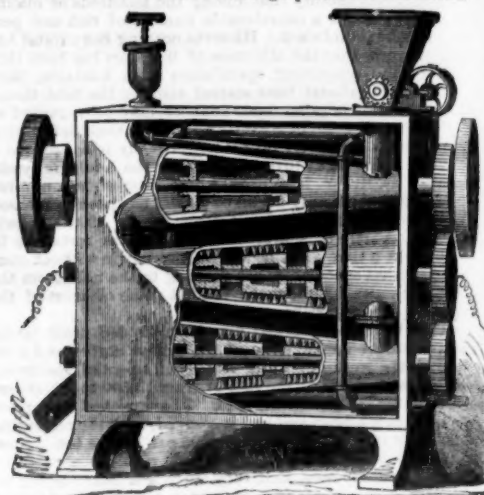
PERFORATED IRON, STEEL, COPPER, AND ZINC PLATES IN VARIOUS DIMENSIONS AND THICKNESSES.

Shipping Orders Executed with the Greatest Dispatch.

## NOVEL ELECTRO METALLURGICAL MACHINE.

PROFESSOR JAMES MANES AND SONS call the attention of miners, mineowners, capitalists, and others interested in working of gold or silver mines to their new Electro Metallurgical Machine for extracting fine and rusty gold from sands or tailings of stamp mills, or the sands of hydraulic gold diggings, or from black sands on the coast of Oregon or California, and other parts of the world where gold is found.

The problem that has long troubled the worker of free-mill gold and silver ores is a method to save the mineral now lost in tailings of stamp mills or flumes. This alone, if it could be applied, would amount to many million dollars profit each year, enabling the working of much territory which is now lying idle, and want of an economical and thorough process of treatment.



Prof. James Manes and Sons, of Denver, Colorado, U.S., have invented a machine (represented in the above engraving) which will save nearly the entire amount of mineral which passes through the loss not being over 10 per cent., and in many cases not in excess of half amount. The machine is a cheap and practical process—it never needs charging or cleaning up, being nearly self-acting. Steam, electricity, and mercury are used in the process of extracting the mineral.

This machine or amalgamator is adapted for free-milling gold or silver, or refractory after roasting. It consists of a series of three or more large cylinders, wider at one end than the other, placed one above the other in a vertical position, a shaft or spindle running through the centre of each. The ore and mercury are fed into the first cylinder, passing into the second and then to the third. The first cylinder is furnished with steel millers, which nearly touch the sides of the cylinder, and revolve at a good rate of speed, turning the mercury and ore. The second cylinder is furnished with large brushes attached to the shaft or spindle, revolving at a high rate of speed, through this a current of electricity is furnished by a Westinghouse dynamo machine, which materially assists in gathering the particles of very fine gold together, and thoroughly amalgamating the metal and mercury. The third cylinder is similarly furnished to the second; into this the amalgam passes, and is again acted upon and mixed by the brushes to catch any gold which may have escaped amalgamation in the second. A fourth cylinder may be added if found necessary.

The amalgamated pulp then passes through a revolving copper drum, with quicksilver inside. As the drum revolves it takes up the most part of the amalgamated gold. As the inside of the drum is constantly washed with a spray of water from perforated pipes fixed inside of said drum, a clean-plated pulp is constantly brought in contact with the pulp or tailings as it passes out of the cylinders. After leaving the drum it falls down on to incline copper plates the same as is now used in stamp mills.

The amalgam can be collected from the drum and plates without stopping the machine, and any live quicksilver that passes will be caught in syphons. The tailings are carried off with the water. The machine when attached to the water will be driven by the waste water; it sifts the fine sands from the coarse gold and amalgamates it as above.

The specific points claimed by Prof. Manes and Sons in their patent are:

1.—The saving of almost all the mineral passing through the machine.

2.—The loss being less than 10 per cent.

3.—The entire absence of loss of the amalgamated material, thereby saving the mercury, which, with the processes now in use, there is a large loss of mercury and the precious metal.

4.—The small cost per ton at which the ore can be treated.

By the addition of the powerful current of electricity that passes off the revolving brushes, the most minute particles of gold will be caught and retained, which in the ordinary flume and stamps passes off with the water; this amounts to a large percentage.

The inventors state that if English stock companies will give their attention to work the black sands of Oregon and California by paying for the building of the machines, they will take a share of the gold for their services, or they will send their machines to any part of the world, or will sell patent rights to those desiring any of their patent machines or revolving furnaces for roasting, smelting ores, ball pulverisers, &c.

Prof. James Manes and Sons are agents for the Morey and Sons Ball Pulveriser, that crushes and pulverises at the same time, and does as much work as eight stamps in a day, crushing either wet or dry.

PRINCIPAL OFFICE OF

Prof. MANES and SONS,

No. 372, Glanarm Street, Denver, Colorado, U.S.A.

All our machines and furnaces are made by the Colorado Iron Company of Denver, Colorado, the most extensive mining machine works in America.

## PERFORATED SHEET METALS

FOR

TIN, LEAD AND COPPER MINES,

MILLERS, BREWERS, AND

MALSTERS,

COLLIERIES AND

QUARRIES,

COFFEE ROASTERS

AND

SUGAR REFINERS.

ALDRED & CO.,

WORKS: PARKER STREET, ASHLEY LANE, MANCHESTER



Original Correspondence.

THE BARRIER RANGES SILVER DISTRICT.

I subjoin abstract of an interesting series of letters which have been published in the South Australian Register with reference to the silver mining district on the Barrier Ranges, just within the South Wales border, and about 330 miles from Adelaide. As the district is much more accessible from Adelaide than from Sydney, the trade is tending this way, and our Government is about to commence a railway there. My former letters have mentioned this great field; and I need only add at present that the results every week seem to confirm what we have heard of its richness. I am going there next week for a syndicate, and will give you my observations. The Advertiser's correspondence is fully borne out by private information which I have received:—

After spending a fortnight, as I have done, in close and critical examination of the Barrier Silver Mines, and thoroughly investigating the evidence obtainable as to the value and prospects of this new field, it is impossible to come to any other conclusion than that on the surface it is undoubtedly one of the richest silver mining areas in the world, and that it promises to be both a permanent and profitable field for investment. The surface deposits have been tested both by the assayer and the smelter, and as to their value there cannot be the shadow of a doubt; but as there has been only one deep shaft sunk in the recognised silver ore district, that only to a depth of 80 ft., it would be the extreme of rash for anybody to declare positively that these mines will prove permanent or otherwise. Fortunately in every case where the surface has gone below the surface, and there are a number of claims which prospecting shafts have been put down from 10 to 30 ft., the results rather gain than lose in richness and thickness, and it is rather a strong probability that among the hundreds of claims which have been pegged out a considerable number of rich and permanent mines will be established. Hitherto nothing but capital has been wanted; but now that the attention of investors has been thoroughly aroused, and prominent speculators from Adelaide, Melbourne, Sydney, and Ballarat have started visiting the field themselves, the introduction of abundant finances may be regarded as assured, and the establishment of Silverton as one of the chief mining centres in Australia is extremely probable. Already it has proved a centre of wealth to a few lucky investors, notably the Adelaide syndicate, represented by Mr. W. R. Wilson, whose interest in a number of claims, which cost them only 6000*l.* or 7000*l.*, has been purchased by the Barrier Ranges Silver Mining Association for 120,000*l.*, paid in cash and partly in shares. Mr. Wilson was fortunate in getting on the field at a time when he was able to buy without competition; but now that speculators are flocking to the field from the principal colonies I believe the market value of most of the claims will rise enormously.

The mines that have been worked here have yielded much larger results than any on the Pacific slope of the United States, and that, with less costly working, while assays of selected specimens of pure metallic silver at the rate of from 15,000 to 20,000 ozs. per ton, are not unknown on this field. I have picked up a piece of silver at random from a heap and had it assayed, with the result that it was almost pure silver at the rate of 4000 ozs. to the ton. Now, if it is borne in mind that a 3 or 4 ft. lode will pay a profit on the surface, it will be readily seen that very much less than the big results I have instanced will mean a fortune to the lucky holders of claims. I had a look the other day at a claim where the deepest shaft for you could not call it a shaft, was not more than 10 or 15 ft., yet out of that and a much smaller hole on the same line of reef taken 14 cwt. of ore, which on being treated in Melbourne averaged 3000 ozs. of silver to the ton right through. The way in which the Barrier Silver Mines really suffer very much by comparison with Nevada mines is in the width of lode and the quantity of ore. In Nevada the lodes were of extraordinary width, but of less richness, owing to the segregation of the ore into great ore-bodies. On the Barrier the lodes are only a few feet in width; but carry bunches of such rich deposits obtainable so near the surface and at such little cost as to be equivalent in value to the wider poorer lodes in other countries.

Many capitalists have been neglecting this place in the most extraordinary fashion, although it is within the New South Wales territory, but Melbourne and Adelaide speculators have been more alert, and the result is the successful formation of a company called the Barrier Ranges Silver Mining Association, with a capital of no less than 120,000*l.* A large proportion of this has to be paid away in the form of claims; but when all this expenditure has been met there will still be a capital of 150,000*l.* in hard cash available for the development of the company's property. A few words will explain how the company came into existence. Nearly a year ago Mr. W. R. Wilson, to whom I have previously referred, one of a syndicate of Adelaide speculators, went on to the field, saw the claims as they were prospected, purchased an interest here and an interest there, finally became the largest holder of silver claims on the field. Wilson was there early, before the rush set in and before high prices were asked, and was consequently able to buy large interests at what would now be considered remarkably low terms. Among the claims was the Apollon, the best developed and richest known in the district. Some months later a Melbourne syndicate, represented by Messrs. Brigham and Marshall, went to Silverton and purchased interests in several of the principal claims then developing. The two syndicates thus became possessed of a large proportion of the best country, and it was for the purpose of purchasing their united interests that the Barrier Ranges Silver Mining Association was formed. I believe the Adelaide syndicate, which is known as Wilson's, invested about 6000*l.* or 7000*l.* in the purchase of claims, and the Melbourne syndicate, known as Brigham and Marshall's, have invested about 19,000*l.* in the purchase of claims, and will receive 85,000*l.* in cash and shares, to be paid by the new company for their interest.

A special report has been made by Mr. Norman Taylor, late field agent in connection with the Geological Survey Department of Victoria. This gentleman visited all the principal mines, and examined them critically, with the view of ascertaining their value and genuineness. In one part of his report he expresses an opinion much more emphatic and conclusive than anything I have ventured to say on my own responsibility. Mr. Taylor says:—"Taking the mines as they are, they are certainly the finest mineral property I have seen, and when the railway already surveyed by the South Australian Government to the border, and within a short distance of these mines, is completed, which it doubtless shortly will be, it will open up probably the richest field for mining enterprise ever developed in these colonies." The same gentleman in another portion of his report says:—"In the Thackaringa Mines there are no indications of silver proper, but the galena contains a large but variable amount of silver, in many cases yielding returns from Europe which throw our best gold mines into the shade. The more northern mines at and near Lake's Camp, are silver ores, assaying up to, I believe, 20,000 ozs. silver per ton; but it remains to be proved how deep these ores may go. The chlorides and chloro-bromides of silver are very surface ores above water level, formed by the decomposition of sulphides. Judging from the pretty general occurrence of copper pyrites in the lodes, the ore below water level will most probably be of the numerous mixed sulphides rich in silver." I have quoted Mr. Taylor's report thus freely because so far as I know he is the only independent authority as yet whose opinions would be regarded as reliable. Those opinions, however, are more than fully borne out by those of the practical men engaged here, and what is more important, by the actual facts disclosed by the working of a number of the mines.

One of the best tests of the commercial value of surface ore that has been made in connection with Hawson and Collins's claim between Lake's Camp and the place known as the Soakage, a sample of lode, from 10 to 15 ft. deep, were sunk by the prospectors on this claim along the line of lode, and 2 or 3 tons of ore

raised. From this about 14 cwt. of good-looking ore was selected and taken to Melbourne by Mr. Collins for treatment. There are no smelting-works in Australia capable of treating silver ore in large quantities, and it was, therefore, decided by Mr. Collins that rather than incur the delay of sending the ore to England and awaiting returns he would have it smelted by the Victorian Pyrites Company in small charges. I think I cannot do more to show the *bona fide* character of this test than quote Mr. Cosmo Newbery's report:—"The ore consisted of chloride, bromide, and iodide of silver with brown iron ore, carbonate and sulphide of lead, oxide and sulphide of antimony, and traces of bismuth. The richest portions gave on assay nearly 53 per cent of silver, but much of the ore was very poor, and owing to the similarity in appearance it could not be separated by hand picking. An average sample, after crushing, gave on assay about 3000 ozs. per ton, and I then advised Mr. Jobson to smelt it in a reverberatory furnace in small charges of 1 cwt. each. This produced a rough metal containing lead and antimony, which was partly refined by smelting and oxidation. The whole of the slags were smelted, and the furnace run as clear as possible. On the whole, the treatment has been satisfactory, though with larger quantities it could be done much more expeditiously, and the cost would be much less. A little ore still remains in the slag and on the furnace bottom, but this will not pay to obtain except by future smelting further lots of ore." Notwithstanding this assurance in the last sentence of the report the proprietors of the ore were determined to get out the whole of the silver, and they insisted on a further test, with the result that 175 ozs. of silver were obtained from the slag and 510 ozs. from the bottom of the furnace. The total amount of silver obtained from this ore was 2575 ozs., for which the proprietors received an advance of 515*l.*, being at the rate of 4*s.* 1*d.* per ounce. The freight, wharfage, smelting, and other charges amounted to 53*l.*, so that the proprietors of this 14 cwt. of ore, which Mr. Cosmo Newbery stated was a mixture of poor and rich, received a net profit of 462*l.* These figures I have taken from the original accounts and other documents, and are, therefore, quite reliable. I know another claim which is now the property of the Barrier Ranges Association, from which 3 tons 18 cwt. of ore was sent to England for treatment, and the returns showed a net profit at the rate of 150*l.* per ton. There are 35 tons now on the way from the same mine, but the returns will, of course, not be received for some time. Several other instances might be mentioned in which small quantities of ore taken from the upper portions of lodes have gone very rich, and have given a very large profit on the working and treatment, but as I had no means of checking the statements furnished to me I refrain from quoting the names of the claims.

It would be difficult to say whether the really richest portions of the field have yet been discovered. It was thought by most of the prospectors themselves that when the country about Lake's Camp, Lake's Grave, and the Soakage had been pegged out there would be no further opportunity for prospecting, but two or three splendid discoveries in the neighbourhood of Mount Gipps seem to indicate that valuable silver deposits will be found in that direction. The other day a prospector, named Julius Nickel, one of the best on the Barrier, came across a good-looking outcrop near Mount Gipps, and immediately pegged out a claim on behalf of Mr. Wilson and party, in conjunction with whom he is acting as a prospector. Five specimens were taken from the lode and assayed. One gave no trace of silver, and the other four gave results varying from 1100 to 4800 ozs. of silver to the ton. A couple of days afterwards another prospector, who had been smart enough to follow up Nickel and peg out an adjoining claim on the same line of reef, was paid 500*l.* for a third interest. The specimens from Nickel's claim just referred to were selected from about 3 cwt. of stuff, taken out of a hole about 4 ft. square and 3 ft. deep. Quite a rush of prospectors has set in to Mount Gipps, and we shall probably hear of plenty more finds there before long. There has also been a small rush right out on Corcoran Station, no less than 680 acres having been pegged out one day last week. Altogether some hundreds of square miles have been taken up under mineral lease on the Barrier Ranges, and only await capital to develop them. The rush of prospectors which is now setting in towards this district will probably result in the floating of a number of companies, and the development of the best of the claims.

The Umberumberka Creek, which flows past the town of Silverton, appears to divide the rich silver ore country from the galena ore country. The Apollon, the Hen and Chickens, the Pluck Up, the Lubra, Austin, and Collins's, and all the other rich silver lodes, are north of the creek, while the silver-lead mines, such as the Umberumberka and the Thackaringa mines, are to the southward. All these southerly mines have been practically deserted since the rich finds to the northward. They are all regarded as good properties, and will probably be worked at a large profit before long. The only southerly mine to which I need make special reference is the Umberumberka, which is situated only a couple of miles out from Silverton. This is a silver-lead mine, and is being worked by a public company with 16,000 shares of 1*l.* each, of which only 3*s.* per share has yet been called up. Out of this capital 200*l.* had to be paid for the claim, promoters' shares allotted, brokerage, and a variety of other expenses incurred, which left an available working capital of only a few hundred pounds. With this money 15 or 16 men were employed sinking a shaft and a couple of winzes, and making drives, with the result that a large quantity of silver-lead of varying quality was obtained. Unfortunately all the veins pinched out are proved to be nothing more than bunches, so that it was impossible to obtain a good working lode anywhere near the surface. One lode 4 ft. thick, and yielding splendid ore worth 50*l.* per ton was struck, but it ran out quickly. The shaft has now reached a depth of 132 ft., where they have struck water, and have apparently entered on a good lode, but unfortunately operations cannot be proceeded with as rapidly as desirable, owing to lack of working capital; and as many of the shareholders have neglected to pay up the last call the number of men at the mine has been reduced and work is going on slowly. As I stated before, there is really nobody on the field who can be regarded as a first-class authority on silver mining and the classification of silver ore. This has been illustrated in the case of the Umberumberka Mine, from which a large shipment of ore of indifferent quality was sent to England, and a loss of 1000*l.* thereby incurred by the company.—Adelaide, July 3. J. B. AUSTIN.

GOLD MINING—NEW SOUTH WALES.

SIR.—The activity at the Bingera diamond fields continues, and the Government officials express hope that at length there will be visible results. It is believed that Prof. Liversidge, of Sydney University, will visit the ground at an early date. Subjoined are the principal items of news:—Mr. A. S. Lowe, of Sydney, has secured a prospecting protection area on the Basalt Mountain, so highly spoken of by the late Rev. W. B. Clarke and other geologists as likely to be very rich. Mr. Lowe has had a shaft sunk nearly 300 ft., and has engaged a diamond drill to prospect the ground thoroughly. Mr. Lowe is acting single-handed. It is thought that the Government ought to deliver the drill in Bingera. In Upper Bingera Hanlon's crushing of 40 tons yielded over 3 ozs. to the ton. They are now crushing for Neal and Co. The Melbourne Company is letting out the work by contract. At the diamond fields Rogers's machine, for testing the ground of other leaseholders, will be at work in a few days, when the extent and richness of the field will be better known.

Some rich specimens are being exhibited at Mudgee from the claim of Gregor and party at Hargraves, and one of the partners in Bond and Co.'s claim at Hargraves reports to the Sydney partner:—"In some of my former letters I told you that a drive westward of the long one would have to be pushed in some 12 or 15 feet. This is now an accomplished fact. I have now to tell you that another 'gold parallel' has been met with. It is poor so far; but evidently mining operations will have, after awhile, to be prosecuted in that direction to ascertain the value of this new discovery, which I believe will ultimately lead to payable results, and as we happened to cut this gold parallel just after a break of the strata I have strong hopes of my expectations being realised. The party are engaged slabbing the shaft for a few feet up from the bottom, in consequence of the softness of the ground on the vein. The vein at the bottom of the

shaft is nearly 18 in. thick, and shows gold freely. We intend to sink the shaft 20 ft. deeper.

Rain has now fallen at Timora, and at length the dams are full. There are also reports of rich finds; Buckley and party got 50 ozs., one piece weighing 28 ozs. At Barmadman last week 99 tons from the Fiery Cross reef yielded 544 ozs. of amalgam. The crushing of the stone from Jackson's claim not finished: 500 tons of quartz from the Italians and spare ground gave 92 ozs. of gold. A small crushing of 2 tons 12 cwt. of stone from Kiandra, crushed at the Reefer Battery, Adelong, has turned out fully up to expectations. The stone yielded 11 ozs. of gold. A small parcel of 12 cwt. of stone, belonging to Burns and party, Adelong, yielded 2 ozs. 12 dwts. A crushing of 4½ tons from the Garibaldi reef, at Sharp's Crossing, gave 1 oz. to the ton. The escort left Adelong on Thursday with 973 ozs. 15 dwts. 17 grs. of gold. The Commercial Bank sent 605 ozs. 4 dwts. 11 grs., and the Bank at New South Wales 368 ozs. 11 dwts. 6 grs. At Parkes Miller and party have cleaned up 96 tons from Bartley's Creek for a yield of ½ oz. to the ton. John Medlyn and party, Bonnie Dundee, are now crushing. They have between 500 and 600 tons to go through. The Sunny Corner Silver Mines are causing great excitement among mining speculators, prospectors, and others, who are to be seen coming from all parts, the greater number coming from Bathurst and Sydney. It is a great many years since Mitchell's Creek was so active. Messrs. Newton and Co. are busy erecting smelting-works to treat the silver ore from their mine, of which there appears to be an unlimited supply. There are about 80 men employed at present. Mr. W. T. Harley is manager of this mine. Several other parties have struck the lode on leases adjoining, amongst them being Messrs. Harley and Co., Tonkin and Co., and Hemsworth Bros. For miles round the country has been taken up in mineral leases, and prospecting is being carried on vigorously. At Mitchell's Creek gold mining is kept going by Messrs. Brown Bros. Their battery is going constantly, crushing their own stone. They also crush for the public at the liberal price of 7*s.* 6*d.* per ton. The Paddy Lackey Company (Cook, Graham, and Co.), at Dark Corner, are still raising good stone. They have about 130 tons at the surface. From a trial crushing from the 160 ft. level they got 17 dwts. to the ton of retorted gold. This looks well for the future of this claim, as the reef averages about 3 ft. in thickness. The main drive south is in 70 ft., with a face of quartz 5 ft. in width. The north drive is in about 70 ft., reef averaging about 2 ft. 6 in. The quartz is very hard. There is a light crushing plant about a quarter of a mile from this claim, where this company used to crush; but, since late improvements and deeper sinking at the mine, this machine is inadequate to their requirements. With heavier machinery for crushing purposes this claim would turn out a large amount of gold.

There does not seem to be much inducement so far for working miners to go to Silverton, although some of the claims are undoubtedly rich, but there are reports about which seem too bright. As an instance, it is said that an official communication has been received in Sydney from Menindie, giving some remarkable information regarding the richness of one of the silver mines at Silverton. There are three or four shafts on the lode, the deepest being 87 ft., and the lode in the mine maintained an average width of 3 feet. The ore tested and in sight is valued at 100,000*l.*, besides which the writer of the report from which this information is taken was informed that ore to the value of 60,000*l.* has already been despatched from the mine. The ore when brought to the surface is classed into five different grades, some of which are sent direct to Germany for treatment, while the rest is put aside in the hope that some day it may be treated on the spot. The quantity now sent away weekly is from 10 to 12 tons, which at the lowest calculation is valued at 300*l.* per ton. The entire cost of raising, carting, and freight to Germany is about 20*l.* per ton, which leaves a clear profit of something like 2000*l.* per week. One gentleman owning one-fifth share in the mine, sold half of his interest last week for 16,500*l.* The quantity of silver and silver-lead ores in the Barrier Ranges is said to be unlimited; but, as the means of transit is both expensive and limited, it is only the high-class ore that can at present be treated. Of the mines, Mr. Norman Taylor, late of the Geological Survey of Victoria, who has visited Silverton, reports:—"We reached Silverton on May 20, and pushed on to Lake's Camp at once. The main direction of the route from Adelaide to Terowie is due north, thence north-easterly to the border of New South Wales, keeping the same line till Silverton is reached. I visited the Apollon Mine on the night of arrival, and again the following morning. The Lake's Camp and Soakage Mines are the only mines I have seen in which the rich chloro-bromides of silver occur, although there are many others in the neighbourhood. The mines are situated to the north-east of Silverton from 11 to 20 miles. These ores are not found in the Thackaringa mines, the lodes there being argentiferous galena (silver-lead). The principal mine at the Lake's Camp is the Apollon. The lode was struck on the surface, and is now worked in two shafts, No. 1 on the underlie to a depth of 70 ft.; and No. 2 20 ft. vertical and 35 ft. underlie, the two being connected by a drive at that depth 65 ft. in length. The strike of the lode is nearly due north and south, with a dip or underlie of 51° to the east. The most important feature is that as far as present proved there is no change in the rich character of these lodes, which consist of true silver ore in contradistinction to the ordinary silver-lead ores, of which there are several on the eastern side of the same valley. The Hen and Chickens was also inspected, situated south-east of Lake's Camp, on the road to the Soakage. The lode is somewhat similar to the Apollon; but containing, in addition, carbonates of copper, lead, and iron. So far as I have at present seen for myself, and from inspection of specimens from nearly every proved lode in the district, I have not yet seen any indication of sulphides of silver; but it is possible, from the presence of carbonate of copper, that these lodes may ultimately change in depth into some of the rich silver-bearing mixed pyrites ores.

Payable tin has been found by Macdonald and party 12 miles from Deepwater. Telegrams from Emmaville report that Berry and party are raising splendid wash, and it is stated that a large sum has been offered for the claim. Flannery and party have two engines going constantly, which are gradually beating the water, and consequently they are making better progress in sinking. They are draining the whole area beyond the Wesley Company's land, thus proving that they are on the continuation of the same lead. We have had several light showers, but a heavy downfall would be welcomed for mining purposes. A very promising find of tin was lately made by Capt. Green, late mining manager of the Union Gold Mining Company, Dalmorton. It is situated in the New England district, near Dundee, county Bald Nob, and the prospects show such good results that a company to work it has been successfully floated under the No Liability Act. The promoters' shares are all taken up, provisional directors have been appointed, and steps will be taken at once to get everything into working order to commence active operations. The mine is to be named after the prospector, and will be called the Captain Green Tin Mining Company, Horse Gully.

Except at Mitchell's Creek and Sunny Corner mining is at a standstill in the Bathurst district. There is a healthy state of things in the silver mines at Sunny Corner. Grand results are expected when the smelting-works are finished. The appointment of a mining warden for this field was much needed. There is a firm belief that Sunny Corner will quite rival Silverton. The Burrage Copper Mines are in full work, giving good employment to from 200 to 300 men. From Lucknow (Wentworth) Mr. H. W. Newman, manager of the New Reform Gold Mining Company, reported to-day:—"I have taken out and cleaned a bonanza from the Industry claim worth 300*l.* I will cask it to-morrow. I have also cleaned up 165*l.* worth of free gold. I will bank it to-morrow. The mine generally is looking well, and the machinery is the same as usual. The Woolloomooloo Company (Mount Macdonald) has finished retorting from its maiden crushing of 40 tons of quartz. The result is highly satisfactory, the total yield being 138 ozs. 14 dwts. 5 grs. of gold. The Caledonian Tribute crushed 55 tons for 33 ozs. 14 dwts. of gold. The Glen Innes Bismuth Mine is developing splendidly, and the shafts which have been opened are rich in ore. The last consignment of 1½ ton, which was sent to England, assayed over 60 per cent., and realised 857*l.* The company has several offers for the purchase of the property, one being from an English syndicate, but the shareholders expect to place the mine for 10,000*l.*



In Queensland mining matters appear to be progressing favourably. Advice from Brisbane state that Captain Bennett has left Townsville on his return trip to Melbourne. He reports favourably on the Monterosa and Argentine mines, and expects to be back soon from Melbourne with capital to begin operations. At Rockhampton there is still much excitement in mining circles. Two applications for leases were made on Monday, one at Crocodile and one at Mount Morgan. The returns from the Mount Morgan claim are almost fabulous, and no share in it can be obtained. Excellent prospects have been received from the Crow's Nest. There are six shafts and drives, and a reef has been struck in each. An eighth share was sold for 750*l*. Telegrams from Cairns report that the alluvial lead recently discovered at Herberton is looking promising. Another shaft has been bottomed on 2 ft. of payable wash. There are now five different claims on payable tin on this lead. The country is all pegged out, and there is no chance for strangers.

At Gympie the dividends paid upon mining scrip from the beginning of the year to date amounts to 135,000*l*. North Glamire have declared a dividend of 466*l*, odd, and Glamire 800*l*. Warden Lukin report that the operations for May were very successful. The yield of gold was 10,706 ozs. from 5304 tons of stone, being an average of 2 ozs. 9 grs., and giving a dividend amounting to 28,765*l*. The Ellen Harkins lead, from 54 tons gave 5524 ozs. (over 46 ozs. to the ton) in two months. The shareholders have received a dividend amounting to 23,400*l*, which is the net proceeds from 124 tons of quartz. The Wilmot Extended during the month crushed 195 tons for 3526 ozs. 5 dwts. Nos. 3 and 4 North Glamire crushed 1104 tons 1 cwt. for 938 ozs. 4 dwts. The Phoenix p.c. crushed 1184 tons 18 cwt. for 1283 ozs. 17 dwts. No. 1 North Phoenix from 793 tons obtained 446 ozs. North Glamire Mine from 214 tons 8 cwt. obtained 43 ozs. Nos. 2 and 3 South Smithfield Mine crushed 765 tons for 721 ozs. 10 dwts. The Golden Crown from 793 tons 15 cwt. obtained 379 ozs.

At Charters Towers everything is going on quite satisfactory. At Day Dawn the mill has been running continuously during the fortnight nine days with 20 heads, and three days with 15 heads. The machinery, and also the electric light, are giving every satisfaction. Estimated stone crushed 463 tons, for a yield of 1266 ozs. 5 dwts. of smelted gold. Estimated stone raised at the mine 268 tons. There has nothing been done in the sinking since last report. Have been putting in plat and making ready to drive No. 6 level, and laying the rails down permanently. There is about 12 ft. of formation, and all stone. It is intended to keep three shifts on in this level until it is in a little way, and then commence sinking again; the other parts of the mine are also looking well. A dividend, the 62nd of 3s. per 24,000th share has been paid. From the Peabody Extended J. Elford, manager, reports—The mine is looking a great deal better than at my last report. The reef in the stope varies from 6 in. to 20 ft. in thickness. There is about 20 tons of stone up of fair quality. From Day Dawn No. 6 west, Thos. Gelling, manager, reports—Since last the underlie has been sunk 46 ft., making a total depth of 120 ft. There is about 4 in. of stone, carrying a little gold. Other reports state that the Mosman Company have crushed 944 tons, for a yield of 1803 ozs. of gold, and the tailings are expected to yield 250 ozs. more. The Day Dawn Blooky Gold Mining Company have obtained 753 ozs. gold from the past fortnight's crushing. A crushing of 150 tons from the Caledonia prospecting claim has yielded 254 ozs. gold. R. D. A.

Sydney, June 30.

#### MINING IN NEW ZEALAND.

[FROM OUR CORRESPONDENT.]

SIR,—Mining enterprise in this colony was never, in the memory of the oldest inhabitant, at a lower ebb than at present. Failure in 99 cases out of 100 has resulted; and even when a measure of success has rewarded the adventurer, the greediness to have every farthing divided, without the least heed for the future, has only too often resulted in the enforced abandonment of a really valuable property for want of reserve funds. The excitement caused by the discovery of so-called diamonds in this district a few months since has quite died away, and some considerable amounts of money were lost. It is, however, curious and somewhat interesting to be told that Mr. Jacobson, who claims to have been the discoverer of these gems (?) still stoutly adheres to his belief that they are diamonds, notwithstanding the opinion of experts to the contrary. In an interview with the writer Mr. Jacobson stated that it is only a question of time for the stones to be recognised as diamonds, and that the parties at home who declared that the samples were wanting in specific gravity and hardness will yet live to see their mistake. He declares that the stones have not been "exposed to the air long enough to inhale sufficient oxygen." This certainly sounds funny, but Mr. Jacobson is a gentleman of undoubted respectability, and I am sure would not wilfully mislead. A little excitement appears to be imminent over a discovery of copper at Malvern. Several parties of prospectors have recently brought down some specimens of ore which look promising, and with a return of anything like prosperity to the colony doubtless we may expect a few small companies on the tapis. Business generally is dreadful; from all sides complaints are rife; and a general election occupies a prominent position in men's minds just at present. The opinion here is prevalent that the Government now in power has a good deal to answer for, and all classes of the trading community appear intent upon getting Sir Julius Vogel as Premier, under the belief that he will raise another large loan, and so contribute to the present prosperity of the country. The thinking portion of the community, however, shake their heads at the idea, and declare that a reckoning day must come. This colony is not such a paradise for the working man as it has been represented; and it may not be out of place to state that there are now, in Canterbury alone, hundreds of skilled mechanics out of work. Carpenters specially are at a discount, and were it not for the low price of the necessities of life, such as meat, bread, &c., the outlook would be gloomy indeed. Small capitalists are wanted here now, but even they in many cases had better remain at home. The climate certainly is beautiful; but even that has been over-rated, the dreaded "nor'wester" (an indescribably hot wind) being sufficiently frequent to make life miserable; the feeling of utter prostration it causes to be appreciated must be experienced. House rents are rapidly falling owing to the number of empty tenements; a good cottage can be had for 8s. per week; meat is 2d. per lb., and bread 4½d. per 4 lb. loaf; potatoes can be bought for 56 lbs. a shilling, tea 2s. per lb. Any person of small means can live here at a cheaper rate than in any place I ever visited. Board and lodging, as an instance, may be had with meat three times a day for 12s. a week, and really respectable hotels charge but 20s. A good dinner consisting of soup, joint, pastry, and cheese can be bought for 6*l*. Splendid reports have been received from the Silverton Mines, New South Wales. Many of the assays have yielded at the rate of from 15,000 to 19,000 ozs. of silver to a ton of ore. Only a few days ago, so says the Lyttelton Times, a solid block of ore weighing 258 lbs., and estimated to contain 300*l*. worth of silver was obtained only 18 in. below the surface of one of the claims. The country has been pegged out for miles in all directions. Christchurch, Canterbury, June 25. M. A.

#### CANADIAN COPPER COMPANY.

SIR,—I look every week in the *Mining Journal* for a report of this company similar to the reports that usually appeared therein some time ago about every fortnight, but I have been unable to find one. Why have these reports been discontinued? As a shareholder I should be glad if you could occasionally insert something of this unfortunate mine so that I may see where I am. I have not been able to take up any of the bonds that were lately offered to the shareholders, but I trust that other shareholders have applied for all that was offered. Why does not the secretary send you some account of the company, and not keep the shareholders 12 months in suspense? Could not meetings be held half-yearly? I am pleased to see that there is an improvement in the copper market, and that our shares are quoted in the Stock Exchange at a little higher price. Is there a justification for this, or do the purchasers buy merely because there is an improvement outside of the company? Let us know something so that we may know how we stand. X. X.

Manchester, Aug. 13.

#### EARTHQUAKES, AND MINE EXPLOSIONS.

SIR,—From the destruction which occurred I imagine that the intensity of the recent disturbance in Essex and adjacent counties was slightly below that of an earthquake which in 1880 unroofed and shattered many of the buildings in Yokohama. On that occasion the maximum distance through which a point on the surface of the earth moved to and fro did not exceed 1 in. This, however, did not determine the intensity of the disturbance, which depended on the maximum acceleration or the suddenness of the movements. Sometimes in Tokio we experience earthquakes lasting 30 or 40 seconds, which are exceedingly large, but on account of their slowness they have been altogether unnoticed excepting by those who were provided with instruments. On the other hand, earthquakes occur in which the ground does not move more than the tenth of an inch, which are felt by everyone as severe disturbances. When we record a suddenness, or rate of change, of motion equal to 2 ft. per second, we may expect damage to occur like that which has just happened in England. From the observations recorded, had a diagram of the disturbance been obtained, it would in all probability have shown the following characters:—First, there would have been a series of minute tremors. These would have been approximately coincident with the sound which the writer describes like that of a rushing wind. These might be too minute to be felt, and six or eight of them would occur per second. After this would come the shock, consisting of two or three back and forth movements of large amplitude. Lastly, the phenomenon would end by a series of irregular movements, the period of which would grow longer and longer as the disturbance died out. At places distant from the origin all that would be recorded would be a series of slow, pulse-like movements, such as seem to have been observed by persons in the neighbourhood of London.

In Japan earthquakes have been recorded lasting over four or five minutes, the whole of a disturbance has never yet been "captured." At the commencement of an earthquake many of the vibrations are lost on account of their extreme smallness, while at the end of the disturbance many of the concluding vibrations have been lost on account of their extreme slowness. As to the direction in which the senses of observers told them the "waves" had travelled, I may remark that with the exception of the shock the "waves" probably moved the observers in almost all directions. If a pea or any small point on the surface of the ground could have been observed it would have been seen to have moved in ellipses, in spirals, in paths, like the figure 8, and to have gyrated and wriggled in a multitude of the most varied directions. Nor can any reliable information be obtained from the side to which bodies were overthrown or projected, unless the observer can assure himself that the earthquake acted like a single blow. After an earthquake I have often found a set of small columns lying upon a bed of sand prepared to catch them pointing in all directions like the arms of a starfish. These facts are based upon the observations of many hundreds of earthquakes with every variety of seismograph and seismoscope with which I am acquainted. My object in recording them is to give those who experienced the earthquake some idea as to the true nature of the phenomenon, the knowledge of which is unattainable without the use of instruments. Almost every week during the last two or three months I have obtained diagrams of earthquakes at spots not more than 800 ft. apart, at one of which the intensity is invariably four or five times greater than at the others. An interesting psychological study will be the moral effects produced by the disturbance.

Before earth-movements can be generally understood, it is necessary that they should be observed as other natural phenomena are observed. A reason that has been expressed against the establishment of seismometers in British observatories is, that in Britain earthquakes are a rare occurrence. Such a reason appears to arise from an imperfect acquaintance with the phenomena to be observed. Earth-tremors, which are minute earthquakes, may be observed in Britain every day. Then there are the slow earthquakes or earth-pulsations, like those which I have from time to time observed in Tokio. Whether these exist in Britain cannot be known until they are sought for. That they existed on the outer rim of the area where the Essex earthquake was felt is tolerably certain. It is also certain that shortly after great earthquakes—as, for instance, some which have shaken South America—pulse-like motions have been observed in the bubbles of astronomical levels at places as distant as St. Petersburg. When we consider that we are observing meteorological changes, with which earth-tremors have a close relationship, that we observe the tides, magnetic and electric changes in our earth, and the escape of gas in our mines, with all of which earth-movements may be closely associated, when we possess so many earthquake-shaken colonies, and send our navy and mercantile marine to all the earthquake countries of the world, it would certainly not be an unreasonable undertaking for us to investigate the ill-understood phenomena which continually occur beneath our feet.

Tokio, June 7.

JOHN MILNE,  
Hon. Sec. Seismological Society of Japan.

#### THE BLOW-PIPE IN CHEMISTRY, MINERALOGY, AND GEOLOGY.

SIR,—The author of the volume bearing this title being apparently dissatisfied with the review of it published in the *Mining Journal* of June 28, I also have carefully read the book and made a few notes, the publication of which, if you will find space for them, will present another opinion upon the work. The book, notwithstanding its small size, and the devotion of a not inconsiderable portion to tables of geological strata, "characteristic fossils," shells, &c.—which, we may be permitted to say, have no very apparent connection with "anhydrous analysis"—is nothing less than an attempt to revolutionise the whole recognised system of chemical analysis of ores, &c., by the blow-pipe, which it professes to enable the student to perform without the aid of the ordinary acids, nitric, hydrochloric, &c.; invariably until now appealed to, in part at all events, by operators with this instrument. Now, it is undeniable that if this can be really effected, a very large and most useful class of Englishmen—mineralogists, metallurgists, mining surveyors, engineers, curators of museums, &c., and even many chemists themselves would be much, or even incalculably benefited; and we have, therefore, carefully examined this work, blow-pipe in hand, with the view of ascertaining how far such formidable pretensions have been fulfilled. The work is divided into 12 chapters, of which the first four are devoted to the author's description of the manufacture or adaptation of the various apparatus required—blowers, lamps, supports, pliers, lenses, &c., which we may pass by here as being useful only to the small number who cannot afford to purchase these apparatus, and to pay (rather heavily it must be admitted hitherto for such simple articles) others, who make a living out of the manufacture of scientific instruments rather than make such themselves.

This convenient stride brings us (at page 60) to "the structure and management of pyrocones;" and as many of our readers may not know precisely what a "pyrocone" is, or may be somewhat alarmed on the supposition of some unforeseen connection with nitro-glycerine or skyrockets, we hasten to explain that this term (pyrocone) is simply applied to what has hitherto been known as "the blow-pipe flame." The author attempts to prove that the idea so long prevalent, and to be found asserted and often illustrated in almost every chemical work, that the blast from a blow-pipe penetrates the resulting formation from a lighted candle or a lamp, and forms what are called "outer and inner flames"—is erroneous; he states on the contrary, that the blast moves along the upper surface of the flame, which, by a vortex created in the surrounding air is sucked in, and thus converted to the conical shape certainly observable in every blow-pipe flame. This knowledge the author states (but we cannot exactly see the force of his reasoning here) is of extreme importance to the operator; on the contrary, we may assume that if the same or similar results are obtained by the chemist holding the old opinion, it does not matter much which is the correct one.

Passing on, we now come (page 77) to what seems to us a really important innovation on the recognised system of blow-pipe analysis. The author states under the head "Reagents" that whereas the

old system of applying the powdered oxide or "earth," or what not, a bead of borax before the blow-pipe, produces, in his philosophy "merely a jumbled solution of everything, in which the colours given to the bead by minor colouring agents (as iron, nickel oxides) are completely overwhelmed by any stronger colouring agent present (as, for instance, cobalt oxide)." Boron trioxide, which he calls "boric acid," but which will be better recognised by old name, "boracic acid," if used as a reagent before the blow-pipe performs "almost instantaneously" a chemical analysis or separation of the oxides, &c., in the assay thus treated upon it, and, moreover, that the different oxides thus separated as borates, or rather, pyroborates, may be immediately obtained *per se* and weighed in an assay balance, by simply boiling the containing and soluble beads in water, where the contained and separated borates are insoluble. It seemed to us, if true, such an important fact—nothing less than saving the chemist the labour of several days in his laboratory one simple operation of a few minutes—that we took our blow-pipe apparatus (a Bunsen's oil lamp, and Fletcher's hand-blower) as tried by the author's methods, a portion of the mineral cerite (generally called allanite) from Norway, as being a good complicated one of them, because this mineral contains, according to Rammelsberg—SiO<sub>2</sub> 31.86, Al<sub>2</sub>O<sub>3</sub> 16.87, Fe<sub>2</sub>O<sub>3</sub> 3.58, FeO 12.26, CaO 21.27, La<sub>2</sub>O<sub>3</sub> 2.40, CaO 10.15, MgO 1.67, H<sub>2</sub>O 1.11=101.17.

We found our boracic acid bead when a trace of cerite powder was thus treated upon it, turn opaque, milk-white, but canary-yellow, hot, which, according to the author's tables, denotes the presence of lime and alumina, coloured (yellow) by iron peroxide. We then, according to the author's directions, boiled this opaque bead in distilled water, and obtained a considerable number of brown transparent spherules, which, on referring to Table III., page 90, the book, might be either due to oxide of cerium (containing, of course, didymium and lanthanum) or to oxide of manganese. On examining the light transmitted from the largest spherule by a spectroscope we saw (certainly with more distinctness than in the strongest chemical solution we have tried), the well-known didymium absorption bands at D and E<sub>h</sub> of the spectrograph, so that there could be no doubt of these borates being those of cerium, &c., and not of manganese. But what of the large proportion of silica; of the 12 per cent. iron protoxide present? These were undoubtedly present, but as the spiritualists say, "made no sign."

The rest of the work contains two chapters (X. and XI.) devoted to a supposed dialogue, with illustrative experiments, between American and English chemists, concerning novelties, not merely blow-pipe analysis, but in received chemical opinions, which, whether proved or not, are not of sufficient practical interest to extract here. Chapter XII. consists of detailed analyses of 42 minerals, all 84 analyses on the old (Freiberg), and new (Col. Rammelsberg) systems, which may be interesting, but we have not space to go into them here, and of six more tables—"Quantitative Arrangements of Silicates with Types," "Typical Mineral Combinations," &c.

We observe several contradictions, or, perhaps, misprints—as, where the author states (in the mineral analyses), that the sublimate afforded by antimony ores on aluminium plate "whitens P.P.;" but in Table V., page 104—"The reactions of volatile metals on aluminium plate"—that the "black sublimate of antimony is not altered in P.P." Which of these two opposite statements is correct. On the whole, however, the book is, in my opinion, tolerably well printed, illustrated, and got up.—Aug. 4.

#### GOLD IN WALES—(CROWN LEASES)—No. XLIX.

SIR,—A Crown mining lease is a subject that cannot be carelessly dismissed from consideration at any time, more particularly just now, when it is apparent that serious attention has been given to it at the Treasury, and that something most beneficial, as per Mr. Courtney's declaration in the House of Commons, has actually been decided. This is, no doubt, a capital start on the road of relief to the mining industry, as well as to the augmentation of the national income. Truly, as the old saw has it, it is never too late to do well, and never too soon to begin; and, for one, I shall greatly rejoice to see the movement can be kept up until the Crown become the perfect exemplar of mine lordship. There is not the ghost of a reason why the Crown should not, but a good many reasons could be adduced why the Crown should be the great exemplar.

Our beloved Queen is a highly appreciated example in all domestic relations that concern her teeming millions of people; and by possibility could it be inappropriate if her High Commissioner should care for her that all avenues to industry are cleared for the benefit of the nation, and that she should throw up one's hat in exultation at the bare idea of the Commissioners of Woods and Forests displaying "anxiety" to develop their mining properties. I can scarcely understand the Conservative-Radicalism of a correspondent in last week's *Journal*. How he can wish to raise again the fallen one-fourth-profit claim passes my understanding; but it is not worth while this hot weather to follow it to the tomb of the Capulets. I never had the slightest respect for it (although I had for its author), and shall not follow it further. Good riddance!

From your Whitehall correspondent's observations seem to issue ray or two of hope that coming events may be casting their shadows before, and that the time may really be not very far distant, when, as he says, "a statement in a prospectus that the property is held under a Crown lease will suffice to command prompt subscription of necessary capital" (to work with), "assuming always that royalty is payable, as in Prussia and elsewhere, upon profits, and not upon produce." The writer further urges that "the real alternative required in Crown leases is with regard to the payment of royalty"—and prescribes that "the payment should be made 5 per cent. even 10 per cent. on profits, but there should be no royalty payable when the capitalists are receiving no profits." If unattainable the suggestion is perfectly reasonable; for it is satisfactorily done in Prussia it can be done here as well, or better, perhaps. Undoubtedly the working of minerals is the most important of national industries, and there is no solid reason even now why mining should not enjoy high reputation, and a period of comparative prosperity.

True it is that mining must always have the stamp of adventure upon it, and its unsubstantial attendants possibility and probability will always be sponging on the adventurer; but what of it? Mr. Macawber will remain true to his tenacity be the "turn-up" never so long in the coming. But Mr. M. is not so absurd in his sit-at-stone practice as he is made out to be, for there is scarcely anything that can do that does not have somehow a good deal of the adventure in it. In fact, an infant is born into a world of adventure, and is sure to find it so to the end of his sojourn therein. Infants of all growths and ages like it. They will speculate and gamble in some way from the highest in the land to the lowest.

The kinds and degrees of speculation are legion. In mine speculation there is always some substantiality, some hard material to work upon in and under the soil. On the Stock Exchange, where the noisy atmosphere is fraught with little else than probability, the case is vastly different. There, dealing in nothing but shadows, leads to something; but oftener, by far, to the calculated goal of taking nothing from nothing and leaving nothing. In mining there is always something, and worth in it; and it is not always had of the something that its owners make nothing of it. For a long while I have harboured the idea and promulgated it, that minerals should always rank before vegetal and animal matter. Of the Trinity in Creation inorganic matter certainly takes precedence, for all fixed vegetal life draws its food therefrom, and all moving animal life feeds partly on it and partly upon organic matter which has grown therefrom. Hence the importance of our country's mineral matter, and all that concerns it.

I need only allude to the stores of bottled-up sunshine in the state of coal, and the wondrous use of it under big boilers to put water into perspiration for the creation of power, thousands of fold above and beyond all natural power, for the production of all sorts of things. As to this mineral matter, to what else does England owe all her accumulated wealth and greatness, which nobody can calculate? The whole of it is traceable to her minerals. True it is that we have encouraged mining everywhere else in the world, to our detriment and the neglect of home mining. The present depression



this branch of industry, however, in my opinion is to be attributed less to imported mineral produce than to the inappropriate and suicidal action of our mine lords.

Whilst adventurous people of the mining persuasion were both able and willing to pay high rents and royalties for mineral leases, mine lords were quite within their right in taking all that people were willing to give them. But now that workable mines are deeper, and necessarily more expensive to work, and the baser metals are only about half the value they were in 1872, the mine lords might, perhaps, be to their interest (costing nothing but resolution) to lower their rents and royalty to workable figures. If the Office of Woods, &c., will set the example, I am quite persuaded that much good will come of it, and that owners of private lands will not be slow in following suit.

Possibly during the last 30 years I may have been considered somewhat of a nuisance at Whitehall-place by pegging away at what honestly thought the inappropriate, as in some respects practised, were in regard to gold licenses. However much I may have annoyed them, I am in candour bound to say that nothing on earth could have exceeded the courtesy of the Hon. Commissioners towards me throughout. I have never troubled much about the baser metals; it is pretty well known that I consider Merionethshire the gem of all the counties, and that I interest myself chiefly in its gold associations, wisely or not remains to be proved.

Probably I have had more to do with gold licenses in Merioneth than my own account than any other individual, and have worked harder and longer at them than anybody else. At this moment I am interested to the value of a postage-stamp in a Crown lease, either do I hold stock or share in any company whatsoever—mining otherwise. The number at the head of this communication will show that I have freely published a good deal of what I know of the Crown and other metalliferous lands of my favourite district.

But, what is the blank fact whilst writing? There is not a single Crown sett at work in the whole of the district. The cause of this is not far to seek. Two or three years ago, in connection with a mining Q.C., we had more than a score of Crown gold licenses all at once in this district of the Mawddach, for which we paid 10s. each. A considerable expense I re-explored and experimented upon, more or less successfully, the whole of these; but the 1-12th royalty on "gold and gold ores" alone, without any definition of "gold ore," except that it was "gold ore," together with the obnoxious one-fourth profit clause, and the obligation of taking a separate additional license on the same terms for working the baser metals, the same setts, put the idea of renewal of licenses, or application for leases, under such crushing conditions out of prudential thought. These are all now I believe unlet.

Anybody who has taxed himself by reading all I have written by and starts about this lovely district, and its actual and probable gold produce will, I think, acquit me of affectation in the matter. He will know that all along I have advocated concentrated and systematic efforts in dealing with what I believe to be a most important question—that of gold seeking in Wales.

I am at present interested in one mine only in the district, and that is on private property. Surrounding this mine are 100 or more Crown setts, which are all idle, and most of them have never been since they were mapped out. Now, I am willing to take them all on trial licenses for a year or two of thorough prospecting, it falls in with the desire of the Office of Woods and Forests to develop these mining properties, with, however, the following provisos:

- 1.—That the Crown licenses cost only 5s. each for the year, as used to be the case when I first had to do with them.
- 2.—That royalty should extend to "all minerals and metals whatever," as in my first lease from the Crown.
- 3.—That the royalty should be reduced from 1-12th, as it now stands, to 1-20th, as is the practice of the Duchy of Cornwall, and Lord Lisburne, and other leading mine lords in Cardigan and elsewhere.
- 4.—That the one-fourth profit clause of course be deleted.

This would produce 5000l. a year in aid of the Exchequer at the least, in the place of nothing. And whilst the Office of Woods, &c., are twopenny, fourpenny, and sixpenny rentals, they might almost as profitably tell the idea of creating "fivers" out of nothing. I think the Chancellor of the Exchequer might find gold forthcoming pretty satisfactorily if his attention turned in this direction.

In conclusion, I may state that I feel "free, able, and willing," to assist gratuitously, under the Crown in furtherance of the expressed anxiety as to the development of its mineral rights, particularly in the gold-bearing rocks of Merionethshire.

London, Aug. 12. T. A. READWIN, F.G.S.

#### COPPER MINING COMPANIES.

First.—The Pannicillo Company has just issued a card to its shareholders announcing the estimated profits in Chili for the six months ended June, 1884, as 15000l. This amount would be insufficient to cover the interest on debentures and the London office expenses; but, fortunately for the company, the directors had the forethought to carry forward from the last year's accounts the large balance of 18000l., so that next October there will be an available sum of 33000l., which, if the price of copper should not further decline, will admit of a dividend of 1s. per share, or 2½ per cent. per annum, as against 6s. per share, or 15 per cent., in the corresponding six months of 1883.

This remarkable decrease of earnings will be better understood when the profits of the past two years are contrasted. During the six months ended December, 1882, the Chili profits were 20,5000l.; during the six months ended June, 1883, the Chili profits were 15,5000l.; during the six months ended December, 1883, the Chili profits were 13,5000l.; and during the six months ended June, 1884, the Chili profits were 15000l. Happily for the shareholders of the Pannicillo Company there are a few "bears" who are obliged to cover their sales, and the price of the shares remain a little under par, which some persons would consider high for a property paying 15 per cent. per annum.

It is stated that Rio Tinto can make a profit on the production of copper at 35s. per ton. Whether this be an exaggeration or otherwise, it is not right that the future interests of all the copper companies should be sacrificed for an immediate gain to the Spanish companies, who will eventually by reason of the continued low value of copper find themselves no better off than the Pannicillo Company. It is expedient that the shareholders in Rio Tinto, Mason and Barry, and the Tharsis Companies should arouse themselves to the true position of their properties.

B. J. C.  
84, Martin's lane, Aug. 14.

#### NORTH PENSTRUTHAL MINE.

First.—The stopping of this mine, so long legitimately worked, is to be regretted, the more so as the workings are down to 165 fms., which in Gwynnapp is where tin should be produced. It would be hard to complain of the shareholders as showing want of courage, many of them having stood by the concern through two companies since 1872, holding their interests, large or small, with a tenacity seldom equalled, and showing faith in mine and management. But the constant demand for means has proved too much, and slowly and reluctantly shares have had to be relinquished, until the burden being too great for the remaining holders there was no help but to give in.

It is a great pity so favourable a piece of mining should be abandoned in such a district, and at such a depth. The following facts, communicated to the writer by a Cornishman, will doubtless interest many, and be of service to those who may wish to re-work the mine. "I should like," he adds, "to have seen cross-outs in the bottom of the mine extended north and south, but more especially south, seeing that from the 46 downwards the shaft itself has gone considerably north, nothing having been done south under the 46. At that point two lodes met, one underlying north and the other south. The north underlie seemed to have carried the other with it, and therefore the shaft was sunk in that direction. A considerable quantity of mineral, fetching over 22,0000l., was raised all on the south underlie, while since it has turned north it has been poor. It is just possible that a part of the south lode still kept its regular course, and perhaps still productive, which a cross-out south at bottom would prove." There is another great point south that ought to be tried—the 40 ft.

tin lode. Such a lode burrowed in so extensively by the ancients must have a rich bottom. In not proving this in the 150 or 165 the shareholders have doubtless missed a fortune.

E. A.  
London, Aug. 14.

#### FOREIGN MINING AND METALLURGY.

Depression continues to prevail in the French Iron Trade. The stocks of iron in hand in the Longwy and the Meurthe-et-Moselle districts are reported to amount to 275,000 tons. Quotations for pig are maintained upon the French markets at 2l. 3s. 2d. to 2l. 4s. per ton; but it appears probable that they will fall in view of a possible production of 700,000 tons per annum. The St. Etienne Steelworks Company has received an order for a vessel to be constructed for the Messageries Maritimes. The Denain and Anzin Company is stated to have obtained an order for 11,000 tons of steel rails on Portuguese account. The contract price, it is added, is 1s. 16s. per ton delivered. The intelligence received as to the German iron trade is very similar to that to hand from Belgium; there are few orders, while the production is heavy. The German steelworks and mechanical construction establishments are pretty well employed, but the blast furnaces and rolling mills have but little to do; and the production of pig in Germany in June is estimated at 278,877 tons, as compared with 274,857 tons in June, 1883. The aggregate production in the first half of this year was 1,749,660 tons, as compared with 1,670,354 tons in the corresponding period of 1883.

The Belgian Iron Trade remains in much the same state. Orders continue to come to hand, and the works are fairly employed, but their managers cannot overlook the fact that they have now the winter before them. A recent adjudication of rails for the Belgian State Railways has been shared as follows:—La Louvière, 2000 tons, 5l. 5s. per ton; Angleur, 3000 tons, 5l. 5s. per ton; Ougrée, 3000 tons, 5l. 5s. per ton; John Cockerill, 4500 tons, 5l. 5s. per ton; and Thy-le-Chateau, 2500 tons, 5l. 5s. per ton. The capital of the newly-constituted La Louvière Rolling Mills Company is proposed to be 20,0000l., instead of 12,0000l., as reported in a recent impression. The imports of iron minerals into Belgium in the first half of this year were 775,058 tons, as compared with 766,836 tons in the corresponding period of 1883. The exports of steel rails from Belgium in the first half of this year were 29,700 tons, as compared with 37,046 tons in the corresponding period of 1883. The exports of iron rails from Belgium in the first half of this year were 9858 tons, as compared with 5078 tons in the corresponding period of 1883. The exports of plates from Belgium in the first half of this year were 20,578 tons, as compared with 22,780 tons in the corresponding period of 1883.

In the Belgian Coal Trade prices are low, and colliery proprietors show a desire to reduce their stocks. A recent adjudication of coal required for the Belgian State Railways fully indicated this state of affairs. The number of trucks carrying coal and coke which passed over the Belgian State Railways in the week ending Aug. 3 was 15,918, as compared with 17,388 in the corresponding week of 1883, showing a decrease of 1470 this year. The imports of coal into Belgium in the first half of this year were 574,345 tons, as compared with 583,663 tons in the corresponding period of 1883. In these totals English coal figured for 118,358 tons and 183,371 tons respectively. The imports of coke into Belgium in the first half of this year were 17,667 tons, as compared with 19,788 tons in the corresponding period of 1883. The exports of coal from Belgium in the first half of this year were 2,185,599 tons, as compared with 2,007,023 tons in the corresponding period of 1883. In these totals the exports to France figured for 2,061,632 tons, and 1,873,729 tons respectively. The exports of coke from Belgium in the first half of this year were 431,266, as compared with 530,958 tons in the corresponding period of 1883. The condition of the Westphalian coal trade has scarcely varied, quotations having been maintained at their former level.

#### MINING INSTITUTE OF CORNWALL.

The annual excursion of the members was this year as enjoyable as it was interesting and instructive, the weather (on Aug. 7) being glorious, and the officers of the Institute, particularly the president (Mr. Frecheville, H.M.'s Inspector of Mines), and Mr. W. Rich, jun., the secretary, were most solicitous and assiduous in their efforts to make the day an agreeable and profitable one, and the general arrangements were carried out with marked efficiency. To join the excursion it was essential the members should be up betimes. Residing for the most part in the Camborne and Redruth districts they had to catch the 6-25 A.M. train from Penzance to proceed to St. Austell, where brakes were in waiting to convey them at once to Wheal Eliza Consols. Here a pleasant surprise awaited them. Mr. R. H. Williams (manager) and Mrs. Williams invited the members to a substantial breakfast, laid in a shed which had been tastefully decorated for the occasion. Their appreciation of the exertions of their host and hostess was afterwards suitably recognised by Mr. FRECHEVILLE and Mr. HENDERSON, on whose motion a cordial vote of thanks was tendered to them.

In acknowledging the compliment, Mr. WILLIAMS volunteered some interesting information concerning Wheal Eliza. The mine is peculiar in itself. The most distant level that has been driven is no less than 600 fathoms from the shaft, and the whole of the stuff has to be transmitted through this individual shaft. For four years this long level has been driven continuously with a full "pare" of men, and it is noteworthy that the end-to-day is quite cool and fresh. The ventilation, it is claimed, is simply perfect. It is evident the mine is being worked under exceptionally onerous conditions. The proprietors are not allowed to sink another shaft, and are bound in a penalty of 10,0000l. not to disturb the surface in any way, consequently the whole work has to be done by driving shallow levels under the surface, and the operations often cost 5l. when, in the opinion of the manager, an outlay of less than a shilling should be sufficient. The severe stipulations, however, which necessitate this expensive mode of working have for Mr. Williams and his friends a redeeming feature in that they render imperative a rigid observance of economy. Despite the drawback named Wheal Eliza has been regularly paying dividends for eight or nine years; they have varied from 100 to 20 per cent.; and the lode which is just being intersected promises to be as productive as that which has yielded the riches hitherto. In all these points the members of the Institute were much interested, and they afterwards went around the mine to inspect the machinery and dressing-floors, the general condition of which was much admired.

Subsequently, the excursionists proceeded to Fowey, where again the kindly offices of Mr. Williams were exercised to promote their pleasure. He arranged for the steamer Gallant to take the party for a marine trip. They first steamed for a pleasant cruise for some way beyond the harbour, and then returned and went up the river, the picturesqueness of which was greatly appreciated. Most of the company were strangers to Fowey, and they bore away a most happy impression of the grand natural attractions of the neighbourhood. In the afternoon the President of the Institute entertained the company to an elegant dinner at the Fowey Hotel. The PRESIDENT, having given the loyal toasts, Captain TEAGUE proposed "The Health of the President." He warmly eulogised the many good qualities of Mr. Frecheville, who had deservedly become highly popular among the mining community of Cornwall. He expressed the belief that the Mining Institute had been the means of doing much good. He particularly dwelt on the reduction in the price of dynamite, and claimed that it was largely through the instrumentality of the Institute that the dynamite patent was abolished, and the price of the explosive reduced. There were some monopolies yet to be broken down, and in destroying them the Institute was destined to render still further important service. He did not think the Mining Institute had been as much encouraged as it should have been by some gentlemen in the county. He asked those who were members of the Institute and engaged in the mining industry to be true to their colours, and said it was impossible for them to have a better President of the Institute than Mr. Frecheville.

Probably the most important point in Mr. FRECHEVILLE's response to the toast was his reference to the proposed amalgamation of the

Mining Institute of Cornwall and the Miners' Association of Cornwall and Devon, which has already been suggested in the *Mining Journal*. He said that he had endeavoured to do his duty in the county as Government Inspector, and he could testify that the mine agents in Cornwall had for the most part done their duty. He had had to make some requests of them, but the result of four years' experience was that he had no complaint to make. With regard to the Institute, it was now in its ninth year of existence. The papers read at the meetings were by men of thought and men of practice, and treated with the various subjects taken up in an able and exhaustive manner. It could not then be said the Institute did no good. Besides this they had held several exhibitions of machinery, and they had been the means of introducing some specimens of highly-improved appliances in the county; in proof of this he need only mention Captain Teague, jun.'s ventilator, which was known throughout the county as most efficient. Again, the introduction of the telephone in many of the mines, improved rock-drills, and better and cheaper explosives, had to a large extent been the work of the Institute. The interchange of ideas at the ordinary meetings he could not but regard as most valuable, and believed the results had been most beneficial to the mining industry. He might mention that for some time there had been a growing feeling in the county that an amalgamation should be effected between that Institute and a kindred body that had the same aim as themselves—the Cornwall and Devon Miners' Association. He thought for his part that such a union could not fail to be advantageous to the interests of mining in the county. In the first place, on the one hand, they had the Mining Institute, with about 150 members—a society composed of men who were mine-owners, and had practical knowledge of the working of mines. In the second place, they had a society which had for its main objects the institution and holding of classes to teach the working miners, or those amongst them who had the desire to rise to be mine agents, such subjects as chemistry and mineralogy, and in these days when such rapid strides were being made he thought the union of the two societies could not fail to be of benefit to mining generally. The Miners' Association comprised, roughly speaking, between 80 and 90 members, and about 180 students or associates, so that the proposed new body which he hoped would be united would comprise about 240 members and 180 associates. Although the matter was not yet completed, he might say that a joint committee from both societies had had numerous meetings, and a code was drawn up and a scheme of amalgamation made, and he hoped before long they would see it carried into effect. He might also mention that they had secured the mutual co-operation and sympathy of the science and art classes of Camborne and Redruth, so that they would see the united society would be one of importance. Then came the question—what would all this result in? He believed it would come to a great deal. Was it too much to hope that a Cornish School of Mines would grow out of this? He might say that that was a sketch of what the Mining Institute of Cornwall had been occupied with during the present year, and he hoped the next year would dawn upon a larger and better society in every way. In conclusion he thought they would agree with him they were under a great obligation to Mr. R. H. Williams for his extreme kindness at Wheal Eliza, and for giving them such an excellent opportunity of seeing the beauties of the neighbourhood of Fowey. He proposed "The Health of Mr. Williams."

Considering how much more companies money has gone into Cornwall than has ever come out of it in the shape of dividends, Mr. Williams's reply was in bad taste, and not at all calculated to promote good feeling towards Cornish mining, unless that reply be regarded as a mere after-dinner speech from one who is altogether out of his element when attempting to play the orator, owing to the limited quantity of facts at his disposal. He considered that it was a hopeful sign for Cornish mining that so many present had held their interest in the industry all through the depression. He believed they would see better days, and be rewarded for their patience and perseverance. But they must remember this, that the mines were becoming very deep, and they were called upon to consider how they could the better get the water and mineral out of the mines, and more expeditiously work them underground. He believed they had engineers and mechanics, and thoughtful men, who would prove equal to the exigencies of the period. It was a question to be solved how deep the Cornish mines should be worked, but they might be encouraged by the experience of Dolcoath. He believed "company-mongering" had done much mischief to Cornish mining, but for this the Institute was not at all responsible. [One of the Institute's rules is that no sharedealing shall be carried on during its meetings.] In alluding to the abolition of the dynamite patent, he said that during the opposition to the continuance of the patent by the Institute it transpired that the dynamite company made a million of money out of 90000l. He approved of the amalgamation of the Institute and the Miners' Association under proper conditions. He was glad Mr. Frecheville had been President of the Institute, and said that if all the Government departments were worked with the same integrity, straightforwardness, and truthfulness as Mr. Frecheville brought to bear on his duties in Cornwall they would have nothing to complain of in relation to the administration of their laws, but rather court their existence.

The toast of "Success to Min'ng," and the usual concluding toasts having been drunk and responded to, the party returned by train, having spent a very pleasant day.

#### NEW MANGANESE STEEL.

For an improvement in the manufacture of manganese pig-iron, the object of which is to produce a pig-iron having an excess of carbon by reason of the presence of manganese and a minimum of silicon, a patent has (says the *New York Iron Age*) been granted to Mr. J. F. BENNETT, of Pittsburgh. The inventor claims that the result is a metal of such unvarying hardness as is desirable for stamp-heads, ore-crushers, &c. The percentage of the principal elements in the iron are—Manganese, 8.5 per cent.; carbon, 4.45 per cent.; silicon, .05 per cent. The first step in the process of manufacture is to add manganese ores to the iron ores in the blast-furnace to such an extent as to produce iron of the requisite percentage of manganese. The liquid metal is conveyed from the blast-furnace into a reverberatory furnace, where it is kept until, by the action of the hot gases passing on it, silicon is removed; the metal is then run into pigs, or else the entire charge of the reverberatory furnace is transported by means of a large ladle and rough to the casting mould.

Concerning the amount of manganese ore necessary to add to the blast-furnace charge, Mr. Bennett says that it would depend largely upon the quality of the iron ore and the mode of smelting, and would be governed by the following reactions. If the iron ores contain as much as 1 per cent. of phosphorus, and are smelted with a comparatively cool blast of 800° Fahr., part of the manganese would be taken up by the phosphorus and pass into the slag as phosphate of manganese, and part would go into the slag as silicate of manganese; consequently, it would require ore containing 11.5 per cent. of metallic manganese to give 8.5 per cent. in the finished product; again, if the same iron ores are smelted with a hot blast of 1200° Fahr., the same proportion of manganese would be taken up by the phosphorus, but a smaller proportion would go into the slag as silicate of manganese; therefore, ore containing 10.5 per cent. of metallic manganese would give 8.5 per cent. in the finished product; further, if the iron ores contain as little as 1 per cent. of phosphorus and but little silicon, and are smelted with a blast of 1200° Fahr., it would require ore containing 9.5 per cent. of metallic manganese to give 8.5 per cent. thereof in the resulting pig-iron; hence the most favourable conditions for reducing the percentage of metallic manganese required in the manganese ore to obtain a product containing a given per cent. of the same are iron ore comparatively free from phosphorus and containing a minimum of silica, smelted at a low pressure of blast raised to the highest attainable temperature.

Mr. Bennett has been granted a second patent for a method of producing a manganese pig-iron having a different composition from the above, the advantage claimed for it being that it has superior chilling qualities, and is therefore specially adapted for the manufacture of car wheels. To attain this product the constituent ele-



ments should be present in the following proportion:—Four per cent. manganese, 4.15 carbon, .05 silicon, .375 phosphorus and other metals, and 91.425 iron.

### ROYAL CORNWALL POLYTECHNIC SOCIETY.

The annual meeting of the Royal Cornwall Polytechnic Society has been held this week, at Falmouth, under conditions which must be considered fairly satisfactory. The general character of the exhibition was fully up to the mark, and not only the Polytechnic but the Drill Hall were put into requisition. Perhaps the Fine Art and the Photographic Departments were never really better. Taken all round the Ornamental Art was a good average; the Natural History rather better than usual, but the Naval Architecture was small.

The section in which we are chiefly interested—the Mechanical—had special features of interest in the large and very varied display of gas apparatus of every kind for heating, lighting, and warming, got up in commemoration of the Murdoch centenary. The importance of this section may be judged from the fact that it had to be dealt with separately, and that the application of the needed tests necessarily delayed the awards.

The general display of mechanics, apart from this, was hardly up to the average. An unaccountable delay had taken place in the arrival of many of the articles entered, and some never turned up at all, and were presumably knocking about somewhere on the railway. As the Drill trials did not take place until Wednesday, the judges decided to meet this by dealing then with objects that were not ready to come before them on their usual judging day, so far as that was possible.

The section of ornamental art generally contains something that may be regarded as of special interest to the readers of the *Mining Journal*, and this year this element has been supplied by the exhibits of the Allier Pottery Company, Newton Abbot, which illustrate the use of local clay and other materials in the production of ware and glazes of the highest artistic beauty. No man has done more than Mr. Phillips, of Allier, to advance the development of art pottery in the West, and he has trained a school of skilful potters, several of whom exhibited under his auspices in their own names. Hence the judges were enabled to make a series of awards to the actual workers. First bronze medals to S. Kirkham and F. Lewis; second to T. Mellor and G. Dart; and high commendations to W. White, W. F. Young, F. Findley, J. Budd, B. Norris, and E. Gribble.

The scientific side of the various practical departments was unusually well represented. For the first time for some years the Society had an essay sent in, which was deemed worthy of the special premium offered by the Society and Col. Tremayne, for the most exact account of the phenomena of mineral veins in any mine or district. It deals with the Florida main lode, in Cardiganshire, and is by Mr. Edward Halse, Associate of the Royal School of Mines. It is recommended for printing in the Polytechnic report. Another special premium was awarded to Capt. White for his faithful cross-section of the Wheal Pevor district. The Rio Tinto Company exhibited their notable model of their great open-cast working, which was much admired, and for this a second silver medal was given to the maker, Mr. Thwaite.

Petrology is making some progress in the county, and Mr. T. Clark, of Truro, sent a series of the volcanic rocks of Cornwall, with just 60 microscopic slides of the same, all the sections in which were admirably cut by himself. For this the natural history judges gave a first silver medal. Another series of rocks in the Menage district, with notes on sections by Prof. Bonney, was shown by Mr. Howard Fox, who had also a map of the locality, on which the "conglomerates," &c., were accurately laid down. Some wonderful stones of stream tin ore, the finest from Old Wheal Virgin, Roche, which are believed to be unique, were exhibited by Messrs. Martin, of St. Austell, who had also samples of the clay and bricks (good wine that needs no bush) from Lee Moor.

Mr. W. TERRILL, of Messrs. WILLIAMS, FOSTER, and Co., Morfa Works, Swansea, sent a beautiful assortment of crystals artificially formed in smelting slags. They included—Crystals of magnetic oxide of iron, octahedrons, with replaced edges by dodecahedrons, and also dodecahedral. Crystals of ferrous silicate, oblique, probably allied to pyroxene group; ditto, crystallised against a flat surface, showing lines of aggregation and colours of interference. Crystals of basic silicate of iron, probably allied to olivine. Crystals of copper oxide, cubical. Cubical crystals of cyano-nitride of titanium. Crystals of metallic copper. Rhombic crystals of sulphur-antimonide of iron and copper, probably allied to mispickel. Needle crystals of arseniate of copper, and tabular ditto hexagonal. Crystals of hematite, permeated by a network of metallic copper. Indefinite crystals of cuprite. Bornite in perfect crystals. Blue crystals containing silica and oxide of copper, apparently tetragonal, probably a double silicate of copper and lime. Crystals of white arsenic. Crystals of molybdenic oxide. Crystals of lead purposely made in the well-known place adopted for bismuth. Unfortunately this beautiful and most instructive series was delayed in transit, and did not arrive until the judges had done their work.

A very fine series of models of crystals, imitation precious stones, and the like, by Dr. THEODOR SCHUCHARDT, of Gorlitz, had a first bronze medal.

Mr. A. K. BARNETT, Penzance, sent an interesting little array of electric machinery.

To come now to the Mechanics generally:—Messrs. HATHORN and Co., of London, made a large and excellent display of the Reliance air-compressor, Eclipse drills, and allied machinery. The Reliance has been improved in two particulars—the slide and the inlet valves. In the former the guide now takes all the weight of the slide-rod and valve spindle—a decided and manifest gain. The change in the inlet valve is the narrowing of the seating to the 16th of an inch. These improvements were duly recognised by the judges, who, however, expressed a wish to see a "new departure" in the way of lengthening the stroke, and the substitution of one steam cylinder of larger area for the two used. The Eclipse has been modified by the lengthening of the cylinder and piston, the effect of which is to give a quicker stroke and a heavier blow. The drill awards were deferred until trial, reported below. The hydraulic tunnel bar of the firm has been much improved by "coning" on the column to the hydraulic instead of using a screw. This effects the most perfect and stable of joints. Coning is also introduced into their hose coupling. The judges recognised fully the value of the metallic joint generally, and to the hydraulic column improvement awarded a first bronze medal. The simple and effective donkey pumps of the firm were also shown and much appreciated, but were not reported on by the judges until after trial on the Wednesday.

The BARROW ROCK-DRILL, which was not shown in competition, has an improvement in the fastening of the jumper by means of a heavy collar, which jams into place.

Messrs. HOLMAN BROTHERS sent their Cornish drill for trial; and Messrs. Stephens also exhibited their patent improved reversible tap-drill, with an improved air-valve. These also are referred to more fully in the account of the trials.

Messrs. T. B. JORDAN, JON, and COMMANS, of London, entered their improved "Adelaide" Rock-drill, on Wynne's patent. This drill, which unfortunately did not arrive in time, it will be borne in mind has but one moving part—the piston—and is, therefore, entirely free from any complication of reciprocating valves, tappets, &c. It has been driven at the enormous speed of 1000 blows a minute, is very light, and to ensure the maximum of strength and minimum of weight, with the exception of the cylinder is made almost wholly of steel. The steam is cut off, and worked expansively, and the exhaust very free, the exhaust part of 3½-in. drill being over 13 in. in length.

Capt. TEAGUE, jun., entered the list of rock-drill inventors with a new patent drill. The points set forth were as follows:—First, an improved valve by which the speed of the drill is greatly increased. It is simple in construction, and the action of the air is direct and powerful. Second, the addition of a wrought piece at the front of the machine to hold the india-rubber buffer. This part of a drill frequently gets cracked from the violent blows it has to receive, but by the adaptation of wrought-iron liability to fracture is, of course,

greatly reduced, and facility for repairs increased. Third, the cover through which the piston-rod passes is made in halves, thus enabling the end of the piston-rod where the borer is connected to be enlarged and strengthened. The drill is made of Bessemer iron and Bessemer steel. Capt. Teague likewise exhibited a very compact form of hand exhaust ventilating fan. He claims for this machine a combination of the utmost simplicity, and the most complete effectiveness. The fan stands on its own plate, and has neither pulleys nor belts. The use of such a contrivance would in many places enable the performance of a much larger quantity of work than would be possible without such an apparatus, and with greater regard to health. The fan is driven by a worm and wheel arrangement. Capt. Teague had an arrangement for a safety-skip, which involved the use of two ropes. The cage was put on an endless rope, which passed over pulleys at top and bottom of the shaft, the upper being fitted with an ordinary hand friction brake. The hauling rope passed over another pulley in the usual manner. If the latter breaks the use of the brake will stop the cage from descending; but the model showed no arrangement for effecting this automatically, and in the absence of this the desired security could, of course, only be attained by constant supervision.

Messrs. HATHORN, DAVEY and Co., Leeds, exhibited a quarter-horse power example of their ingenious "domestic motor," a vacuum engine, of simple construction, in which the power is derived from the condensation of steam at the pressure of the atmosphere. As there is not any more pressure in the steam generator than there is in an ordinary tea-kettle, there is, of course, absolutely no danger of explosion. The vacuum is produced by a small supply of cold water obtained from the motor itself when it is used for pumping purposes. The quantity required is about a gallon per minute per horse-power, and it can, of course, be used over and over again when there is a cooling tank. The working cylinder and piston are of bronze, and requires no lubrication. There are no renewable parts, and the only packing needed is a little tallow round the piston and valve rods. No special skill or knowledge is required to drive it, and it may, therefore, be used, as its name implies, with safety and ease, for the power required for a large number of home or domestic purposes. Preferably the fire is of coke, but for small powers gas is employed, and there is a special form with large fire-boxes for burning wood. It is practically noiseless, and as it has no exhaust there is no escape of burnt oil or noxious odours. It is, moreover, exceedingly compact. The judges awarded the motor a second silver medal.

The THOMPSON PATENT PULVERISER, entered by the GLOBE MILL COMPANY, London, but delayed *en route*, is an American invention, the first of which was put down at the Rara Avis Silver Mine, California, where it has been regularly turning out 60 to 70 tons of stuff per day of 24 hours. It is not an attrition machine, but operates by the action of centrifugal force applied upon a forged steel ball. This ball is loose, and propelled by the friction of two flexible discs, avoiding the use of arms, journals, or lugs. The only wearing parts are the ball and its steel shoe-ring. Wet or dry pulverising may be done, and screens of any number of mesh used. An advantage claimed would be a very important one in relation to its adaptation to tin ore, if sustained in practice. The pulverised material, it is said, is not flattened, but left in its natural crystals. The arrangement is compact, and a machine to deal with 60 tons of hard quartz a day, bringing it to a standard of 60 fine would require 10-horse power, and weigh about 7 tons.

Mr. Sissons (Falmouth) exhibited a new and very compact and handy form of steam capstan, designed for trawlers and yachts, &c., which has been well approved in practice; second silver medal.

Mr. THOMAS (Truro) had a second bronze medal for a churn worked by water. Float boards are put on the outside of the box, which thus becomes a hollow axle.

Messrs. BECK and Co. (Southwark) sent their visible drop automatic lubricator. It is intended to supply the lubricant, drop by drop, and well clear of the sides of the pipe, so as to become thoroughly mixed with or permeated in the steam, the number of drops being visible by means of the glass tube through which they rise. In this lubricator all external pipes, valves, glass, &c., are entirely dispensed with, and in their stead one central top and a shielded glass employed, with the triple view of rendering it simpler of manipulation, less liable to injury, more compact, and neater in general appearance. The oil is contained in a cylindrical vessel, and various ports and passages are formed within the lubricator body and the plug, for the passage of the water acting as the driving force and for the oil. First bronze medal awarded.

Mr. JOHN TYSON (London) exhibited a portable hand machine for facing the flanges of steam-pipe, and similar purposes. It consists of a conical-headed bolt, in the head of which slide three expanding pieces for the purpose of fixing into the ends of flanged pipes or other articles to be operated upon. On the shank of the bolt are a loose sleeve, a washer, and a nut. When the latter is tightened the expanding pieces open out and become fixed in the end of the pipe or article, at the same time fixing the loose sleeve and preventing its revolving. Upon the sleeve is fitted a revolving arm, having a slot at right angles to the sleeve, in which slides the tool box, and having a projection in which the handle revolves. The tool box is free to work either way along the slot by means of a screw, upon which is fixed a bevel wheel. The handle of the machine revolves in the projection at the end of the slotted arm, and is connected with a spindle, upon which are fixed two bevel wheels, either of which may be in gear with the wheel upon the screw, according to the way in which the tool is desired to travel along the slot. This capital device had a first bronze medal.

Mr. ROSHER'S "Rainbow" liquid water raiser was one of the appliances seen in operation, and the judging, therefore, was deferred until the Wednesday; first bronze medal.

The slide valve patent steam-pump of Messrs. ASHMOB and WHILE, Stockton-on-Tees, is worked by a slide-valve actuated by an eccentric from the fly-shaft, thus securing great simplicity and certainty of action, and having a great advantage over the ordinary "four-crank system," when dealing with tar, molasses, soap, and other thick or viscous fluids. The ports over which the slide-valves work will pass any floating substance up to one-third the diameter of the suction pipe. Simplicity of construction is of course a main feature; another is the economy effected by the arrangement for cutting off the steam after the commencement of each stroke. This had a second silver medal.

Mr. J. GLANVILLE, of Hayle, sent in the drawing of a Cornish boiler which was intended to do away with the dangerous consequences of the use of impure water. The arrangement was that of an ordinary Cornish boiler set with the axis, which passes through the centre of the shell and the centre of the flue, standing at an angle of about 45°, instead of vertically. Fox's corrugated tubes were also employed; and Galloway tubes were introduced to give greater circulation to the water and strengthen the flue. The two chief advantages claimed for the arrangement were the ease with which the part below the flue could be cleaned; and the active circulation set up by the narrow water space on one side as compared with the wide water space on the other. The judges, however, were unable to see any.

Mr. WARWICK exhibited a highly ingenious arrangement for turning rotating into oscillating motion by means of a slotted ball, a novel application of practical mechanics, which had a second silver medal.

The disinfecting apparatus of the LONDON PATENT AUTOMATIC DISINFECTOR COMPANY is an arrangement which can be applied to any closet or urinal, and which secures the certain application of a due quantity of disinfecting and deodorising fluid every time of use. It is charged with sufficient material for 10,000 gallons of water, and any disinfectant may be used. The judges recommended it for trial.

A series of Mr. LATIMER CLARK'S transit instruments, excellently made, arrived too late for judging. So with a shackle arrangement by Mr. Rosewarne, of Hayle, though incidentally it was not thought to possess material advantage. Mr. Robertson's new rowlocks, a capital invention, which has the rowlock always handy, had a first bronze medal.

Messrs. SABATIER and Co., London, introduced their patent welding cloths for iron or steel. This is a composition held together in

the plate form by a network of wire. The sections to be welded are moderately heated blood colour, and the piece of cloth the proper shape is introduced between the fractures. The pieces being closed together are then put back into the fire till they are a dull white heat, when the entire piece is hammered into shape. In welding iron with cast-steel, the iron is to be heated "dough" and the steel is to be "clear red." The soldering is regular and homogeneous, and it is found impossible to effect a fracture at point of junction, while the quality of the metal is not affected. The saving in time and fuel, moreover, is put at about a third. The judges regarded this as a most valuable device, and recommended it for local trial. Messrs. Sabatier have likewise produced a set of standard wire gauges which meet the requirements of the Board of Trade, and are very compact and handy.

A little pretty scraper, shown by M. DE POIDEVIN, was highly commended; and a new bench stop, by Mr. ROOKE, had a commendation.

There were several examples of good modelling by youths; some of the matters sent in for competition as workmanship were sad examples of wasted ingenuity, which the judges noted as such. One London competitor actually sent in a drawing of a device for perpetual motion by the self-raising of water above or to its level. It was a relief to turn to the beautiful exhibit of engineers' tools cast-steel by Mr. D. LOWE, of Blairgowrie, which were of the minute precision and most exquisite finish, and which had a bronze medal.

The display of gas apparatus for lighting, heating, and cooking purposes was very large and interesting, and quite an exhibition itself. There were no examples of gas engines which have engaged the attention of the society in former years. The tests applied caused some little delay to take place in sundry of the awards, but with the exception of those for stoves, &c., they are as follows. In most of the sections there was a fair amount of competition. A magnificent "Taj" lamp of Messrs. Sugg and Co., which gives a light equal to 450 candles, had a first silver medal. A second silver medal to Cowan's patent gas governor; and a first bronze to the three-lamp patent measuring drum of the same firm. First bronzes were given to Mr. Somerville's working model of machine used in drawing and charging gas retorts, and to his full-size patent dip retort while his regenerating furnace for ground-floor retort-house was highly commended. Messrs. Wright had a first bronze for their improvement (enamelled coating and swing support) in the "Eureka" stove; and the special bronze for the best exhibit of gas fittings was to Messrs. Willey and Co.

The drill trials were of a somewhat tedious and disappointing character, and calculated to strengthen the feeling which is gradually gaining ground, that in the present position of rock-boring machinery, further competitions are a mistake, and that actual work is the only way left of testing the value of a machine, seeing that one now thinks of introducing one that will not do efficient work. The drills were driven by one of Messrs. Hathorn's "Reliance" compressors, worked by an 8-horse portable engine, and the delay largely arose from the inefficient way in which this was fired, and the from a deficiency in the supply of water. During the actual operations, however, the pressure in the compressor averaged 50 lbs. to 55 lbs. There are no points to note in connection with the different machines beyond those already stated, save that Messrs. Stephens introduced a new form of their "Climax." In this machine the valve boxes are fixed at the extreme ends of the cylinder covering the ports or air-channels leading therein; and the piston's movements opens channels at given points leading to the ends of the piston valve. The makers claim that by doing away with the ports consequent upon fixing the valve boxes at the extreme ends of the cylinder, they save the air or steam required to drive them at each stroke, while the shorter distance the air has to travel enables a greater velocity to be attained. The packing of the piston rod, moreover, is effected by placing four segments acted upon by springs, in a recess in the front gland of the machine. With regard to the new drill of Capt. Teague it was claimed on behalf of Messrs. Hathorn that his valve was practically their valve, only made to work in the contrary direction. Capt. Teague, however, did not admit any infringement, and stated that he is using a double valve instead of a single. The holes were drilled in a block of granite nearly 2 ft. thick, and the proceedings were under the direction of Mr. F. W. Michell. Annexed is the record of the performance of the different machines, which is being worked out by the judges, with a view to the announcement of the awards probably some time next week:—

Teague's drill, 3½ in. cylinder, 7 in. stroke, 1½ in. bit, changing to 1½ in.; 19 in. were bored in 3 min. 20 sec. The bit was then changed and 22 in. completed in 25 sec. more—total time, 3 min. 45 sec.

Hathorn's Eclipse drill, 3½ in. cylinder, 2 1-16 in. bit, changing to 1 15-16 in.; 16 in. were bored in 4 min. The bit was then changed and 22 in. completed in 1 min. 25 sec. more—total time, 5 min. 25 sec. The bit used was four-edged, and the size of the hole was larger than that of either of the other competitors.

Holman's Cornish drill, 3½ in. cylinder, 5½ in. stroke, 1 15-16 in. bit, changing to 1½ in.; 16 in. were bored in 4 min. 8 sec. The bit was then changed, and 22½ in. completed in 50 sec. more—total time, 4 min. 58 sec.

Stephens's Climax drill, 3½ in. cylinder, 5½ in. stroke, 1½ in. bit, changing to 1½ in.; 19 in. were bored in 3 min. 5 sec. The bit was then changed, and 22½ in. completed in 25 sec. more—total time, 3½ min.

### MINERS' ASSOCIATION OF CORNWALL AND DEVON.

The annual general meeting of the Miners' Association was held on Wednesday afternoon, under the presidency of Sir JOHN ST. AUBYN, M.P. The special business of the day was the consideration of the proposed amalgamation between the Mining Institute and the Miners' Association, which has been received with almost universal approval.

Sir JOHN ST. AUBYN expressed his regret at the absence of the President, Mr. Molesworth St. Aubyn. As senior Vice-president he therefore, devolved upon him to take the chair.

Letters were read from the President, Mr. Pendarves Vivian, and the Rev. Canon Rogers, expressing their regret at their inability to be present that day.

Among those present were—Sir John St. Aubyn, Messrs. W. H. Hand, J. Henderson, C. Twite, J. H. Collins, W. Pengelly, F.R.S., J. Sara, W. Teague, W. Rich (assistant secretary), J. Beringer (secretary), R. Fox, Capt. W. White, J. Treglohan, A. K. Barnett, E. C. Corn, R. Williams, R. Fox, R. N. Worth, George Mitchell, A. L. Fox, and a large number of students, &c.

Mr. RICH read the Council's report, which called attention to the increased work of the Association as shown by the larger number of students, and the more numerous successes at the recent examinations. The Council regretted that their petition to the City and Guilds of London Institute for a renewal of the grant which for the past three years they had been annually receiving from that institution had been unsuccessful. In expressing their regret at being unable to continue it the executive committee of the Institute called attention to the opportunities of obtaining pecuniary assistance in the maintenance of technical classes offered by the Institute's scheme of technological examinations, and they stated that whilst they were very unwilling to discourage any future application on the part of the Association for the present all their available funds were being utilised for the completion and equipment of their Central Institution at South Kensington. The Council, while regretting their inability to avail themselves to the extent they could desire of the pecuniary assistance offered for the maintenance of technical classes, looked forward hopefully to the success of a future application for a further grant. In accordance with the resolution passed at the last annual meeting the Council sent a memorial to the Science and Art Department of the Committee of Council on Education expressing regret that prizes were no longer to be given to students in the elementary stage, and a hope that on further consideration the minute abolishing these prizes would be withdrawn. The receipt of the memorial was acknowledged. The Department recognised the value of those prizes, but maintained that it had other and more important calls upon its funds—for example, the founding of



ships at the Normal School of Science and elsewhere—and out that this work could be best done by local associations. Council held that whatever difference of opinion might exist as to the relative value of the prizes and scholarships the position taken by the Department was such as to render further discussion on the subject unnecessary. They considered that the question of the Association of prizes to students who passed first-class in the elementary stage should be deferred until the result of the proposal amalgamating that Association and the Mining Institute of Cornwall was known. At a meeting of the Council, held on March 13 last, representation from the Mining Institute of Cornwall, consisting of Mr. J. Frecheville, the President; Mr. J. L. Bolden and Mr. J. J. Anderson, Vice-presidents, attended, and explained that at a previous meeting of the Council of that Institute it was unanimously felt that obvious reasons an amalgamation of the two societies was very desirable, and that they had been appointed to confer with the Council of the Association or their representatives on the subject. The Council cordially endorsed the view that an amalgamation was desirable, and appointed a committee, consisting of the Rev. Canon and Messrs. Pearce, Jenkin, W. Pike, and C. Twite to meet representatives of the Mining Institute, with the view of arranging a scheme for carrying the amalgamation into effect. Several meetings of the joint committee were held, and eventually a code of rules was framed for the government of the amalgamated society, copies had been sent to the members of the Association, together with a request for their views both on the question of amalgamation and the proposed rules. The result would be known at a special meeting to be held after the annual meeting. There could be no doubt that by an amalgamation, the work being done by both societies would be greatly facilitated, and their sphere of usefulness greatly extended. The report concluded with a reference to the name of Dr. Hudson, who was a friend and supporter of the Association.

On the motion of Mr. J. H. COLLINS and Mr. W. HUSBAND, the report of the Council was unanimously adopted without discussion, as that of the Lecturer, with warm approval on the motion of Mr. L. FOX and Mr. N. SARA.

Mr. BERINGER's report was as follows:—During the past session there have been held at Penzance, Penzance, Helston, Hayle, Cammell, Pool, Redruth, and Keyham. The class formerly held at Helston has been discontinued because of the removal of the lecturer, and an attempt made by myself to revive the classes at Helston was unsuccessful. The work done has, on the whole, been satisfactory. This is well seen if we take—as we may very do—the results at the recent May examinations, as indicating amount and quality of effective teaching. The number of successful students is 226, showing an increase of 44 upon that of last year; and at the same time the number of passes has increased from 299 to 373. This increase in the number of students is a sign of healthy growth, but the large proportion of firsts among the students is a still better sign of vigour. According to a recent publication of the Science and Art Department the average percentage of firsts in the passes in the elementary stage is for the United Kingdom about 28; in our classes the percentage is 40. Among the subjects to which increased attention has been paid are mining, geology, building construction, steam, mathematics, and physics. Chemistry has been a slight falling off, and the other subjects must maintain their position. The more technical subjects, mining and mine surveying, have attained at least as much attention in former years; the work in assaying has been much better quality and quantity. It is a subject for congratulation that the of the blow-pipe forms part of the regular course in mineralogy.

#### TREGURTHA OSCILLATING STAMPS.

Mr. MATTHEW LOAM contributed a paper "On the Tregurtha Oscillating Stamps," which was read by Mr. R. N. WORTH. The stamps consist of a battery of four heads, each weighing with its connecting-rod and cylinder 1100 lbs., and being in separate coffer. The heads are driven by a 28-inch horizontal condensing engine, worked expansively, 3 ft. stroke, with a piston velocity of 300 ft., or 50 strokes per minute, the belt from the main shaft at the rate of about 125 blows each minute. The engine is 84-horse power effective, and calculated to drive six heads. The boilers are of ample capacity to avoid any stoppage, and with slow combustion. Starting at first with two heads, the stamps were stamped per head per day. The tinstone was of average fineness, but the tin was of exceptionally fine grain, and had to be used to the smallest grate-hole—No. 36. With four heads over the stamps per head have been stamped regularly per day. Upon Thursday, the 7th instant, the result was a total of 93 tons of tin, or 23 tons 9 cwt. per head, with a consumption of 4 tons of coal. This was a result never before attained, and in contrast with the present standard of 1 ton per head with ordinary stamps. Some striking results had been observed in working. Every blow was complete and effective in itself, in its action and discharge of its product from the coffer. There was perceptible variation in the fall of the head, and the coffer was filled at every blow. There was no repetition of irregular and the blows, as with ordinary stamps. The dressing also proved the action of the tinstone to be perfect, no tin being visible in the bags of the buddles. The concentration of the stamping-power gave a great reduction in the wear of the heads in proportion to the ordinary stamps' wear. During the two months since it started, and since its continuous supply and the working of the four heads, no accident or derangement had occurred, the engine and steam-pipes had not yet been eased, and boiler-house was not fixed. The stamps were, therefore, not working under favourable economic conditions. The consumption of coals at the trial did not exceed 99 lbs. per stamp. This amount would compare very favourably with ordinary consumption, and would be considerably reduced when boiler-house roof was complete and the engine properly eased. It would be seen that while the old stamps had a limited speed which could not be exceeded, the new had practically an unlimited speed. This and the great concentration of power augmented by accumulation and storage of compressed air in the oscillating stamps to give increased force to the blow of the head, an important fact which would sooner or later be recognised in the interest of all mines. It not only saved time and space, but gave greater efficiency and perfection to the stamping, and enabled the produce be dressed more economically and without waste. There was great economy of steam over the old stamps with its great weight of axle, &c., and extended action, so far from the source of power. The cost, estimated by power was, much cheaper; and the stamps, being simpler and more accurately finished, worked with precision and effect. The oscillating was a great improvement on the old pneumatic type. It had only one stuffing-box, fitted with steel elastic rings instead of ordinary packing, and required no oil lubrication, which got into the coffer, and injuriously affected the dressing.

#### THE GLOBE MILL, OR THOMPSON PULVERISER.

Mr. RICKARD read a paper "On the Globe Mill or Thompson Pulveriser." Like all other machines of the pulverising kind, it reduced the ore to have first undergone crushing—the pieces were of the size of walnuts. The feed was by a hopper with jiggling motion; and the pulverising was effected by a ball, operated by discs, the ball was kept by the motion of discs in a continual state of rotation, but was entirely free in its movements, and, therefore, rested on an ever-changing axis. This was the distinctive feature of the Globe Mill, and that which made it, though so simple as a mechanical idea, in advance of any pulveriser as yet invented. The ball had a double motion—one of rotation, another of translation; it combined the pounding action of the stamps and the grinding action of the crusher. Owing to this, the outlines of the discs were found to be definite and regular. This disc seized the ball as it moved, the motion flagged, giving it fresh impetus. It always perfectly spherical. When once started the ball, carried by centrifugal force, tended to fly away from the centre of revolution, and against the steel shoe-ring, grinding the material as it flew round. If a stamp head weighed 800 lbs., and the fall was 1 ft., the crushing force exerted at one stroke was 800 ft. pounds. That

of a ball 180 lbs. weight, diameter 8 in., revolving 300 times per minute round a 30 in. mill, would be 5508 ft. pounds, or in the ratio of 10 to 1. At each revolution the pulverised material was washed against the screen fitted at each side of the mill—that which is in a sufficiently fine state of division passing through to be carried into troughs for any further treatment thought necessary. The action of the screens or grating materially differed from that of the Cornish stamps. The relation of the grate to the mortar was uniformly maintained; and there was a quick and regular, though intermittent, delivery of crushed material through the grate. Another great advantage was economy of power. The work done was constant, and the quantity of water used was only half that of the stamps. Another advantage was that the pulveriser was self-contained and easily fitted. A 30 in. mill, running at 300 revolutions, with an indicated horse-power of 6½, pulverised lately at Greenwich 20 tons of the hardest Indian gold quartz per day of 24 hours.

Mr. R. H. WILLIAMS asked what size the stuff was reduced to for the mill? ["The size of walnuts?"] The stuff for the stamps was not reduced so small as that.

Mr. RICKARD said a larger size mill would take larger stones, but the middle size one was the best.

Mr. RICKARD in reply to questions, said the price of the middle size mill was 400l., and its weight 7 tons. It did the work of 20 ordinary stamps. He would get any stuff tried, and obtain particulars of time, &c.

Mr. RICKARD, in answer to Sir JOHN ST. AUBYN, said a machine working at Greenwich for nearly three months had not worn.

Mr. HUSBAND remarked that quartz stamped much more easily than tinstuff, the proportion being 1½ to 1.

Mr. WILLIAMS did not see that this mill would come into competition with stamps. The stamps took all sorts of stuff, but this would not.

Mr. BARNETT did not think the average stuff supplied to stamps was ½ in. cube; probably ¾ was nearer the mark. Where a stone-breaker was used the stuff could of course be sorted.

Mr. HUSBAND said the reduction of the size of the stuff by the stone-breaker made a considerable difference in favour of the stamps so fed.

Mr. RICKARD explained that he was unable to answer questions of detail, in consequence of the absence of the secretary of the company, which he much regretted.

Mr. WORTH added that he thought the Polytechnic Society had cause of complaint also. A working model of this mill had been entered but not sent, and the judges were, therefore, prevented from dealing with the invention as they wished.

Sir JOHN ST. AUBYN thanked Mr. RICKARD on behalf of the meeting. Mr. J. H. COLLINS offered some remarks upon the shackle exhibited by Capt. Rosewarne, of Wheal Sisters.

#### AMALGAMATION.

Sir JOHN ST. AUBYN then said they had now to consider the important question of amalgamation. Oddly enough he was in the chair at the commencement of the society—its first meeting—and now he was present at what would probably prove its death and resurrection. Sir John then referred in feeling terms to the part played by Mr. Hunt in starting that society, and expressed the pleasure all felt in knowing that he was in enjoyment of good health. He then detailed the various steps which had been taken to bring about an amalgamation between the Association and the Mining Institute which it was felt would be most desirable in the interests of the general mining industry of the county. If it was decided to amalgamate, the Mining Institute would consider the question; and, if that body also decided to join, a united meeting would be held to elect officers and adopt laws.

Mr. TWITE read a letter from Mr. Hunt, cordially approving of the object, and suggesting the Polytechnic also. All the replies to the Council's queries had been unanimously in favour of amalgamation.

Mr. W. HUSBAND then moved the formal resolution approving of the union of the Mining Institute and Miners' Association. In a small county like Cornwall the keeping up a multiplicity of societies devoted to similar objects was felt to be a very great burden. The Miners' Association had done great educational work, and the Mining Institute had done much in bringing together practical men. Amalgamation was following the lines of the Society of Mechanical Engineers. What could be more important than bringing practical men and students into intimate association?

Mr. J. H. COLLINS seconded the proposal, and hoped that this step might lead to something further, and that by-and-by the Polytechnic might be included.

Mr. A. K. BARNETT was very much pleased to support the proposal. United the societies would do work which singly they could not effect.

The resolution was then unanimously carried; Sir JOHN adding that he still looked forward to the amalgamation of all the scientific societies in the county.

#### INSTITUTION OF MECHANICAL ENGINEERS.

Upon resuming business on Wednesday morning the first paper read was by Mr. THOMAS URQUHART, in which it was stated that a locomotive fired with petroleum on the author's line ran down the side of an embankment, taking the train with it, no explosion or conflagration took place. Although it was scarcely possible that petroleum firing would ever be of use for locomotives on the ordinary railways of coal-bearing England, yet the author was convinced that even in such a country its employment would be an enormous boon on underground lines. In one of the tables appended to the paper it was claimed that as compared with bituminous coal petroleum refuse showed an advantage of 56 per cent. in weight and 66 per cent. in cost; and in comparison with anthracite its economy was said to be 52 per cent. in weight and 63 per cent. in cost.—Mr. TOMLINSON was afraid that he would get as badly burnt as scalded if he were to attempt to use petroleum upon the locomotives of the underground railway in London in order to get rid of the smoke. London was a peculiar place; they were not allowed to store anything inflammable.—Mr. BOYS explained the application of petroleum to screw-steamer trading upon the Caspian Sea.—Mr. MARTIN thought that the time would soon arrive when vessels passing into the Black Sea, instead of carrying coals from Great Britain, would find it to their advantage to take in liquid fuel at some of the ports in the Black Sea. It was quite certain that this change would come about in time, and, therefore, contributions such as that of Mr. Urquhart were very valuable.

The value of petroleum as a steam fuel was altogether disputed by Mr. BAIRBRIDGE, who remarked that the author of the paper seemed to hold out no hope for the use of petroleum in this country except for underground work. He had had a good deal of experience in collieries, and he said that neither on the ground of economy, convenience, nor safety would petroleum be of the least use in this country. He pointed out that its cost would be enormously greater than that of coal. In the course of the further discussion which ensued it appeared that petroleum had been applied to various purposes by gentlemen present, but that its use had generally been discontinued owing to heavy cost.—The PRESIDENT, who was received with applause, quite agreed as to the inutility of going into this question as one of money. If they attempted to substitute petroleum for coal there would be a speedy rise in the price of the former.

The last paper read was by Mr. J. H. HALLETT, of Cardiff, "On the Causes and Remedies of Corrosion in Marine Boilers," in which he remarked that marine engineers were all striving in various ways to attain increased economy of fuel in steamers. Among other means of doing so triple-expansion engines of high initial pressure were being introduced, which appear to be gaining much favour, and would no doubt in time supersede the ordinary two-cylinder type. The increased pressure of steam evidently rendered it necessary to be still more guarded than hitherto as to the deterioration of boilers. Steel boilers were now in very general use, and there could be no doubt as to their efficiency; but the writer's experience was that they were equally liable with iron boilers to corrosive influences. On careful scrutiny he had found in steel plates severe corrosion concealed by a very slight scale, upon the removal of which the plate

had proved to be covered with a black substance, probably a black oxide of iron. The principle sources of corrosion, however, might be discussed under the two heads of defective design and defective management, which was equivalent to saying that an ordinary marine boiler would hardly be subject to corrosion at all if well designed and well managed. The most frequent fault of design which bore upon corrosion was the want of sufficient space for allowing a thorough examination to be made of every part of a boiler. The tubes were often placed so far out in the wings that it was impossible to get down to look at the sides of the furnaces, or so close to the furnace crowns that there was no room to get over these. He attributed the principal sources of corrosion to defective design and defective management, and added that an ordinary marine boiler would hardly be subject to corrosion at all if well designed and well managed.

After a brief discussion on this paper, the SECRETARY announced that the remaining papers would stand adjourned until the next meeting, and read the following votes of thanks:—First, to the Marquis of Bute, Lord Windsor, the Mayor of Cardiff, Mr. G. T. Clark (Dowlais), Mr. T. A. Walker, and other gentlemen who had extended so handsome and hospitable a welcome to the members of this Institution on the occasion of their present meeting at Cardiff. The next was to the proprietors of the various collieries and ironworks and numerous engineering and other works in Cardiff, Newport, and the surrounding district for their kindness in opening works to the members, and the arrangements so obligingly made in connection with their visit; next to the authorities of the Taff Vale, Rhymney, Brecon and Merthyr, Great Western, and London and North-Western Railway Companies for the facilities they had so kindly afforded in offering special trains for the excursions; and, lastly, a vote of thanks to the local committee especially to the four officers—the Chairman (Mr. W. T. Lewis), the Vice-chairman (Mr. John McConnochie), the hon. treasurer (the Mayor), and the hon. secretary (Mr. T. H. Riches)—for the admirable arrangements which they had made for the present meeting, and the hospitable reception which they had prepared for the members. These votes of thanks were formally moved by the PRESIDENT, duly seconded, and carried with acclamation, Mr. RICHES responding.

The Taff Vale Railway provided a special train, in which the visitors after luncheon were conveyed to the Rhondda Valley, in order that they might visit the collieries of that district. Every preparation had been made for their reception, and various sections of the train were labelled in accordance with the particular destination of the occupants of the carriages, there being four collieries to visit. There were plenty to occupy attention, amongst other objects of interest which were glanced at en route being Castle Coch, Nantgarw Pottery, Pontypridd Bridge, &c. The first alighting was made at the side of the Great Western Colliery, where a contingent of the excursionists met with a cordial reception from the Chairman, directors, and managers. They were conducted all over the works, such of those who desired to descend to the bowels of the earth being allowed to do so. This colliery, it may be mentioned, is situated at Gyfeillon, near Pontypridd, and has two shafts. In speaking of its winding it may be said that what is called the Hetty Pit is 400 yards deep and 16 ft. in diameter, whilst the output is about 1200 tons per day. The winding engines have cylinders 40 in. in diameter and 5 ft. stroke, and are fitted with Stevens' expansion gear, whilst the flat-rope drums are 16 ft. in diameter. No. 2 pit is 14 ft. 4 in. by 10 ft. 9 in. area, and 430 yards deep, the output being about 300 tons per day. The winding-engines have cylinders 30 in. in diameter and 4 ft. stroke, the flat-rope drums being 11 ft. in diameter. The matter of ventilation, over which Government Inspectors of Mines are so exacting, is well attended to, as will be understood when it is stated that there is a Guibal fan of 40 ft. diameter, driven by a cylinder of 36 in. diameter and 3 ft. stroke, there being a similar engine in reserve in case of mishap. It may also be stated that a Schiele fan is being erected. With respect to the underground haulage by compressed air, which is carried out at this colliery, it may be said that the air-compressor has two steam cylinders of 46 in. diameter, and air cylinders of 42 in. diameter with a 6 ft. stroke. The compressed air works the following underground engines:—One hauling engine having a pair of 14 in. cylinders with 18 in. stroke, and three hauling engines each having a pair of 8 in. cylinders with 12 in. stroke. Steam is supplied to the air-compressors from four boilers, which are fired by the waste gases from 50 copper coke-ovens.

After that section of the company who chose to visit the above interesting works had alighted the train moved on, and made its next stop at Hafod, in order that the Lewis Merthyr Colliery might be inspected. A large number got out at Hafod, and were shown everything worth seeing. In a description of this colliery it is necessary to state that the winding machinery consists of a pair of 42 in. cylinders with 7 ft. stroke, working a spiral drum of 30 ft. diameter, the whole constructed by Messrs. John Fowler and Co., Leeds. The output averages 1100 tons per day. The ventilation is produced by the Schiele fan; and Shepherd's coal washing machine and crushers are employed. The waste heat and gases from the coke-ovens are utilised for raising steam in eight boilers, under which no coal is consumed.

The next arrival was at Porth, for the Cymmer Colliery. Here those of the members who had not got out at the two preceding stations were received by the manager, Mr. Thomas Griffiths. This colliery belongs to Messrs. George Insole and Son. At the old pit the winding is done by a pair of engines with 28 in. cylinders of 4 ft. stroke, working a drum of 11 ft. diameter. The new pit has a pair of winding-engines with 42 in. cylinders of 6½ ft. stroke, fitted with expansion gearing; the drum is 17 ft. diameter. The ventilation is effected by a Waddle fan of 45 ft. diameter, driven by a 32 in. cylinder of 4 ft. stroke, producing 250,000 cubic feet of air per minute. There is a pair of underground engines, hauling from three separate districts. Fisher's apparatus for banking the coal is used, also Shepherd's coal-washing machines and crushers.

The last centre of attraction was at Llynypia, where the colliery visited belongs to the Glamorgan Coal Company. The remaining contingent of members were received by Mr. W. H. Hood, and when they had been hospitably entertained, after the fashion which prevailed all up the Valley, a movement was made for the colliery proper. Some venturesome spirits descended the shaft, and came to bank in due course, duly blackened, but the majority preferred taking a quiet view of things from the surface. The following official description of the colliery will be of interest in connection with this visit:—There are three shafts used for drawing coal. Pits Nos. 2 and 6 are set apart entirely for winning the lower or steam coal measures, and No. 3 pit for the upper or bituminous measures. No. 2 pit is 372 yards deep. The winding-engines have cylinders 34 in. diameter with 5½ ft. stroke, and a spiral drum 15 ft. and 25 ft. diameter. The cages are double-decked, and draw two trams at a time; the total weight, including coal, trams, and cage is about 5½ tons. Underground there are two pairs of hauling engines driven by steam, each having cylinders 18 in. diameter with 3 ft. stroke, and the drums are 6 ft. diameter, geared 3 to 1. One of these engines draws coal from a distance of 1600 yards along a very undulating road; the other from a distance of about 1100 yards along a more regular gradient, down which the load descends throughout the whole distance. The sidings at the bottom of the pit are worked by endless-rope haulage, which is driven by an engine having a cylinder 14 in. diameter with 3 ft. stroke. One of Fowler's clip-pulleys is used of 4 ft. diameter. No. 6 pit is 403 yards deep. The winding-engines have cylinders 30 in. diameter, with 5 ft. stroke and 14 ft. drum, but here the load is only about half that at the other pit. Underground there are two hauling engines, each driven by compressed air, and of much smaller dimensions than those in No. 2 pit. No. 3 pit is only 108 yards deep. The winding-engines are of the diagonal type, the cylinders being 15 in. diameter, geared 3 to 1; the drum is 8 ft. diameter. At this pit there is only one hauling engine, which is situated at the surface, and works two separate planes underground by the main and tail rope system. A 15 ft. Schiele fan placed at No. 6 pit ventilates all the workings of the colliery. The total current of air produced is about 200,000 cubic feet per minute with a water-gauge of 1½ in. The compressed air for working the underground hauling engines in No. 6 pit is supplied by a pair of air-compressors, having steam cylinders 26 in. diameter and 4 ft. stroke and air-cylinders 24 in. diameter. Two pumping-engines, made by Hathorn, Davey and Co., are placed at the bottom of No. 4 pit, which is entirely set



apart for pumping the water from the upper measures. The quantity of water to be dealt with seldom exceeds 400 gallons per minute. There are over 300 coke-ovens of the ordinary Welsh type, 12 ft. long and 6 ft. wide by 5 ft. high; each produces about 6 tons of coke per week. They are all charged at the top, and endless-rope haulage is used throughout for drawing the coal from the pit bank to ovens. Small travelling cranes are used for drawing batches after coking, which are always watered in the ovens.

Some of the first and second class carriages which composed the train were quite new, and were much admired, they having been turned out from the works of Messrs. Brown, Marshalls, and Co., Britannia Railway Carriage and Wagon Works, Birmingham.

In the evening a garden party was held in the grounds of Lord Windsor, at Penarth, all the members of the Institution being invited, together with a great number of the townspeople. Many of the visitors were conveyed to the rapidly-growing watering place by steamer, and others journeyed thither by road and rail. Penarth was quite *en fete*, the beach presenting a particularly lively scene.

A magnificent morning ushered in the third day of the "business-holiday" of the Mechanical Engineers, who assembled as early as nine o'clock at the Rhymney Railway station for an inspection of the famous ironworks at Dowlais and Cyfarthfa. On the road they had a view of Caerphilly Castle, situated among the hills, about 7½ miles from Cardiff. This ruin covers no less than 30 acres of ground, and is the property of Lord Bute, having been left to him by an old miser, of the name of Williams, a few years ago, as well as the famous Pwllpant Quarry, the whole worth about 200,000£.

At Dowlais they were met by Mr. Martin, the manager, who conducted them over the works. The wages paid here average from 8000£ to 9000£ per week, and the hands employed number between 9000 and 10,000. The works are divided into three divisions—the Old, the Ivor, and the Steel Works. At the Old works there are 14 furnaces—six in work, two in course of building, and six out of six blast engines three only are working, two being idle, and one in course of re-erection. At the Ivor Works there are five blast furnaces—four in operation, and the other rebuilding. At the Steel Works there are six Bessemer converters and two blowing engines, four of the converters which are working making some 3000 tons per week. There are also six Siemens' furnaces, turning out some 500 tons a week; and what is known as the Old and New Cogging Mills, adjoining two steel rail mills, rolling above 2500 tons per week. Besides three puddling forges, with some 50 furnaces, there are one plate and seven bar mills, rolling from 1400 to 1500 tons per week. The alterations going on in connection with the Bessemer Works are of a most extensive character, and such as are calculated to expedite the manufacture of steel rails. At the Old Works the principal point of interest was the washing machine, the first of the kind erected in the United Kingdom, at an expenditure of over 20,000£. In an immense building the machine, which is the patent of Coppee and Lubrig, was found in operation, and here it was designed to wash 1000 tons of coal per day. The coal is classified by screens and grading boxes into various sizes, and each washed separately. The fine coal, from 0 in. to ½ in., is washed into 16 Felspar bashes, and all coal above ½ in. is washed into 10 ordinary bashes. The coal washed is of two qualities, bituminous and steam, which are mixed in various proportions according to the quality of coke required. The party afterwards descended to the coke-ovens, visiting first the new Coppee ovens where the washed coal is burnt, and afterwards the old-fashioned ovens. The difference in the quality of coke was a feature particularly noted, and there can be no doubt that the Coppee ovens are destined to be paramount at all such large concerns as Dowlais. A visit to the old blast engine, which is only remarkable for its size, being 12 ft. diameter, with 12 ft. stroke—was next made, and then the steelworks, with the forges, were inspected. Passing through the town, the Ivor Works, with its immense pattern makers', smiths', and fitters' shops and forges, were then inspected.

At the luncheon given by Mr. Clark, Mr. Martin presided, supported by Mr. I. Lowthian Bell on the right, and Mr. W. T. Lewis, High Sheriff of Brecon, and Lord Bute's principal adviser, on the left. The President's health having been drunk with musical honours, Mr. Bell responded, and said that the arts and literature had their classic ground, and no less had the science of making iron its classic ground, and what Mecca was and is to the Mahomedans he thought he might fairly claim that Dowlais was in regard to the manufacture of iron. He was not aware until assured by their Chairman that the Dowlais Works had been in existence for something like 140 years. He had no doubt that Mr. Martin was right; and, if it was so, the history of the Dowlais Works, meant the history of the progress of the iron trade. He did not know whether he had the honour of addressing gentlemen who had any great love for statistics, but they would pardon him if he took them back 100 years, and ask them what was the iron trade then? 100 and 140 years ago the iron of Great Britain—and when he said Great Britain, he meant of the world—was made of charcoal, and the total turn out of pig-iron at that time in the whole of the country was something like three weeks' make of Dowlais at the present time. If they followed the development and the history of the iron trade in almost any part they must have been struck with one thing, the constant change that took place in its locality. At one time it was Staffordshire—of course, he had already assigned the position to South Wales—then it was Scotland, and they had occasionally heard of Cleveland. If they concentrated their attention upon the history of individual works also, it was remarkable how transient their life had also been. There were very few places where the history of ironworks extended over two or three generations. Referring to Dowlais Works, he said the duty had been imposed upon it of providing managers for almost the whole of Great Britain; at all events, the little he knew of the manufacture of iron was imparted to him by a Welshman—the late John Vaughan. Having alluded to Mr. Windsor Richards and the late Mr. Menelaus, whose counsel, he said, he always sought in cases of difficulty, Mr. Bell went on to say it was a remarkable thing in the history of Dowlais Works, the amount contributed in the form of rent. Well, the rental paid by this enormous concern was something like 23£ per year. There was a dispute amongst his friends. One said it was 23£, and the other 25£. He supposed for the purpose of history that he was nearly right; but he believed that now the landlords had insisted upon a higher rent—he would say double, at least; but he was not aware that the Dowlais Company had complained. He supposed the success of the Dowlais Works depended upon the selection of proper men, and, continuing, Mr. Bell paid a very high compliment to the abilities of Mr. Martin, the Chairman.

Mr. MARTIN, in reply to the toast of his health, said that Mr. Bell had told them that the Dowlais Company once paid 23£ a year, but if that sum was not multiplied by thousands now, Mr. William Thomas Lewis (Lord Bute's agent) would be considerably dissatisfied.

A move was then made for the train to proceed to Cyfarthfa, where Mr. and Mrs. Crawshaw came out to welcome them. Although Wales abounds in old historic castles, Cyfarthfa is not one of them. It stands on a commanding position overlooking the works, and at the back, towards Vaynor, there is some charming scenery. The works, which date back as far as Dowlais, have lately been adapted to the make of steel, at a cost of 150,000£. Mr. Bacon, who started Dowlais, also owned Cyfarthfa, but he sold them at the close of the American War of Independence to a London iron merchant, Mr. Richard Crawshaw. An immense fortune has been realised by this family in the last 100 years, one member, William Crawshaw, dying worth seven millions sterling. Robert carried on the works successfully until about 1874, when modern trades union ideas crept into the Welsh valleys, and he closed the works in disgust. If prices revive there is a possibility of the Cyfarthfa Works again becoming as famous for its make of steel as it was for railway iron.

Upon the return of the party to Cardiff, a *conversazione* was given by the Mayor, at the Free Library and Museum, the whole of which was thrown open by the Corporation, and where refreshments were very acceptable after a very heavy day's "pleasure."

On Friday the intense heat of the weather began to tell upon the weary visitors, and the gathering at the Rhymney Railway station

was not so great. The day's programme included visits to the Rhymney and Ebbw Vale Ironworks, the Abercarn Tinworks, and the Alexandra Dock, Newport. The journey to Rhymney was through the Cefn On Tunnel, about one mile and a quarter in length, an engineering work which taxed to the utmost the abilities of the contractors. Only one hour could be devoted to the inspection of the works, which, with the eight collieries owned by the company, give employment to about 7000 individuals. Of the various blocks of Coppee coke-ovens, the principal has 72. In these and other Coppee ovens the waste gas is utilised, but in others it is allowed to escape. There are three blast furnaces on the Rhymney side of the premises; they are rectangular in section, and 52 ft. in height, close topped, and the gases are used for the boilers. In the Bessemer department there are two pits arranged on somewhat different principles. No. 1 pit has three converters, one being kept in reserve; and No. 2 pit two converters. The engine-house adjoining the Bessemer shed contains a pair of converter blowing engines (by Messrs. Galloway), being vertical, by steam cylinders 45 in. in diameter, the blowing cylinders 54 in., with a stroke of 5 ft. The boiler pressure is 70 lbs., and the maximum blast pressure 25 lbs. The 24 in. finishing mill is driven by a pair of horizontal engines of foreign make, having 40 in. cylinders, 4 ft. stroke, and worked with steam at a pressure of 80 lbs. to the square inch. Then there are two hammers, one 7 ton and one 15 ton, adapted to various uses. At night the mill can be illuminated by the Brush electric light.

From Rhymney the party again entered the carriages and proceeded to Ebbw Vale. This vast concern covers nearly 11,000 acres of ground, and at one time paid between 14,000£ and 15,000£ per week in wages. The depression of late years, however, has laid most disastrously upon the undertaking, and probably the wages at the present time paid are not more than half of what they were. The output of the collieries at Ebbw Vale, Sirhowy, Victoria, Waunllwyd, Aberystwyth and Pontypool last year was no less than 1,486,021 tons. The coke made was 273,382 tons, although the coking plant is equal to the production of 340,000 tons. In 1883 the company turned out 5,957,719 bricks, while the production of pig-iron and speigleisen in the same period was 212,412 tons. The finished iron and steel manufactured in 1883 was 131,780 tons, and the castings made 11,578 tons. It will thus be seen that with adequate profits, the business done would still leave a large margin for the payment of dividends.

After a short inspection of the Abercarn Tinworks and the Alexandra Dock, Newport, the weary sightseers returned to Cardiff, where a magnificent banquet awaited them, provided by the Patent Nut and Bolt Company, the caterers being, as before, Messrs. Fort, of Bath. Mr. Grice took the chair, supported by Mr. I. Lowthian Bell on the right, and Lord Tredegar on the left. Mr. Bell, in returning thanks, made the happy remark that Welsh hospitality was like the Welsh coal fields—inexhaustible.

The Mechanical Engineers, who had Queen's weather all the week, were on Saturday made aware of the fact that it sometimes rains in South Wales, and that the heat of an Indian summer is not always the atmospheric condition of the district. The journey from Cardiff to Portskewett to visit the works connected with the Severn Tunnel was performed in fine weather; but during the remainder of the day the rain came down steadily, and cooled the atmosphere. The Severn Tunnel Act was obtained in 1872, and will be completed in 1885, after surmounting many obstacles in the course of its construction; more especially from land-springs, the water from which at one time poured in to the extent of 27,000 ft. per minute. There are now 3000 men employed there, and some time since there were 500 more. The first contractor estimated the work to cost 750,000£, but Mr. Walker, the present successful one, would not undertake the work under 1,000,000£ sterling. He is a model employer, as he has provided chapels, hospitals, schools, and reading-rooms for the men. The total length of the tunnel is over four miles, of which about three miles are completed, and the remainder in a forward state, so that it is anticipated that in a twelvemonth's time the tunnel will be finished. Trains will then run with coal from South Wales to London via Portskewett instead of via Gloucester, and much saving of time will be effected, and the price of carriage of coal lessened.

At the luncheon which followed the inspection Mr. CARBUTT, M.P. for Newport, proposed "The Health of Mr. Walker." He said that croakers, who were not workers, often stated that this good old England of ours was going to decay; but depend upon it, as long as there were men of the character, perseverance, and ability of Mr. Walker, this country would never deteriorate, but continue to take the lead amongst the nations of the world. He regretted that the President was not with them on that occasion, because he would have gone away with the conviction which he (Mr. Carbutt) now entertained—that human nature was a thing to be proud of. They had seen works that day that made them proud of their fellowmen. The Great Western Railway Company, he went on, determined that they would have a new communication with South Wales because they saw justly and wisely that South Wales was the main feature of their system, and that with the completion of this tunnel their traffic would be nearly doubled. He believed that owing to the good gradients, when the traffic of South Wales went through this tunnel, the Great Western Railway Company would be able to compete with the larger lines carrying coal from the North of England, whilst the tunnel would be of immense benefit and service to the district of South Wales. Therefore, he said that when an Institution like that of the Mechanical Engineers visited South Wales, it was right that they should inspect this great work. And members of the Institution would see in the work of that tunnel that engineering was only in its infancy. The more facilities given for travelling, the more people would travel, and invest their money in railways. And it only depended upon capitalists to find such men as Mr. Walker, who could overcome difficulties which would make the stoutest heart quail. It required no ordinary man to face the difficulty which was presented by the flooding of one part of the tunnel in the way it had been flooded. Any ordinary man would have succumbed—he would have died—but Mr. Walker determined upon fighting the forces of Nature, and he had succeeded in the fight. He had brought the forces of Nature into obedience, and it was only by such results that mankind could be benefited.—Most of the company present at the conclusion of the banquet, went on to London, and this concluded the week's proceedings.

We ought not to conclude these observations without a word of praise to the Mayor of Cardiff—Mr. Bird—with whom the Mechanical Engineers left a sum of money to be distributed among the poor of the town. The principal merit of the success of the week, however, is due to the local secretary, Mr. Riches, of the Taff Vale Railway, who planned and carried out the whole programme, and interested the noble landowners and others of influence in a manner which few men could have done, owing to political and religious angularities.

#### WORKMEN AND THEIR EMPLOYERS—No. III.

Frequent changes in the price of commodities, Mr. Weeks continues, increase the number of strikes. These render necessary more frequent changes in the rates of wages and in the relations of employer and employed, and as it is not possible always to agree as to what these changes shall be, strikes follow. The improved methods of communication and transportation, and the remarkable development of manufacturing industry in modern times, has much to do with these fluctuations, and consequently with the increase of strikes. Under the methods and facilities of some centuries ago the periods of fluctuations were spread over many years. Agreements concerning work, or "terms of hiring," as they were called, were for the year, and demands for advances or reductions were made at the time of the yearly contracts. This is changed now; fluctuations in prices follow each other at times with the greatest rapidity, and with them come demands for an increase or reduction in wages, which, if not granted, end in strikes or lock-outs. It will be found, however, that strikes arising from these fluctuations are not always the most frequent during the period of rapid advances, nor lock-outs during a decline, though demands for changes in wages are most prevalent at such times. They generally occur at or near the beginning of such

periods, or near their close. When the market is rapidly advancing or declining the conditions are usually such as to render advance futile, and a demand made is conceded; but when the advance declines in prices is beginning, or when it is nearing its end, there is so much opportunity for differences, not only as to the existing conditions of business, but as to its future, that a peaceable solution cannot be reached so readily as when there is no uncertainty as to the state of prices. It is upon the existence of one or both of these conditions—opportunities for combinations and the fluctuations of prices of commodities, and the advantage taken of their presence—that the frequency of strikes and lock-outs largely depends. War, or may be the real or apparent necessity for an appeal to industrial warfare, neither employer nor employed will inaugurate a strike lock-out, except in very rare cases, without a reasonable prospect of success. In estimating these probabilities the strength and character of the combination that the workmen may form, or that the employer may meet, as well as the state of the market, are the chief determining elements. It will be found that it is a belief that the making the demand is strong enough to enforce it, or that the condition of the market is such that the party upon whom the demand is made can concede it, and will eventually be forced to do so, determine whether or not a strike or a lock-out shall be undertaken.

As to the connection of Trades Unionism and strikes, Mr. Weeks remarks that much has been written about the influence of the Unions upon the frequency of strikes, and as has already been stated there can be no doubt that combinations of workmen or of employers have had a marked influence in increasing the number of strikes. Many never would have been undertaken had it not been for a conviction of success through the power of combination. It is very doubtful if it is true of the strong, well-organised unions that have represented certain classes of workmen for some time. While many of these unions are responsible for some of the most determined, hotly contested, and important strikes of the country, some of which were totally indefensible, it is also true, as a rule, that their utterances and influence are against strikes. Their refusal to undertake general strikes or to countenance local ones are quite frequent. Not only has their positive influence been exercised against strikes, but indirectly they have had a marked effect in reducing their number. Adjustments of wages to which they have been subjected, as a rule, been for longer periods than when rates have been fixed without unions; their strength has made them respected, deferred demands upon the trades they represented until a real necessity for reductions existed, while their accumulated funds and force of public opinion, to which they are quite sensitive, have deterred them conservative and disinclined to enter upon a strike or no other course seemed open.

It is manifestly impossible to secure complete and accurate statistics of strikes. Many are never heard of by others than the parties engaged; and when information concerning those that are known is not refused, the statements made are frequently so incomplete and so inaccurate, and so evidently coloured by the views and supposed interests of the party giving them, that they are far from reliable in many of their particulars. Notwithstanding this, published statistics of strikes are of great importance. They reveal available much valuable information concerning the number, character, losses and results of strikes, and furnish many facts necessary to a decision as to their policy and justice. The most important publications on this subject are the Report of the British Social Science Association ("Trade Societies and Strikes," London, 1884), a paper read by Mr. Bevan before the Statistical Society, London, January 20, 1880—the first attempt to give the statistics of strikes of any country for a series of years; the Report of the Massachusetts Bureau of Labour Statistics for 1880, and of Pennsylvania for 1882, giving the statistics of strikes in these States for a series of years, and the Report on Strikes in the United States, 1880, compiled for the United States Census by Jos. D. Weeks. Reports of several of the Royal and Parliamentary Committees of Great Britain on labour subjects, and the annual reports of the Trades Unions, also contain much valuable information on this subject. These latter, however, are not generally available. Mr. Bevan's reports on 2352 strikes in Great Britain, covering the years 1870 to 1879. The loss in wages alone from 114 of these strikes was 15,067,825. In the writer's Census Report, statistics more or less complete are given of 762 strikes that occurred in the United States, 1880. In 414 of these, 128,262 persons were engaged. The report gives quite full returns from 226 strikes, in which 61,779 persons took part. The time lost was equal to the work of one man, 1,989,872 days, and the wages unearned for this time was \$3,711,000. Of the direct losses in the remaining 506 strikes no statements were received, nor of the indirect losses to capital, to the workmen, or directly engaged, and to the wealth of the country. It is probable that the striking workmen recouped their losses in part from the society funds and from contributions, as well as by working at other employments; but after all allowances are made it still remains a deplorable fact that the waste and loss from strikes are enormous.

The history of strikes abundantly proves that, as a rule, they are not successful; that is, the demand which was the cause of the strike is not conceded. Of 351 of the strikes reported upon by Mr. Bevan in his paper already referred to, 189 were unsuccessful, 71 successful and 91 compromised. Of 149 reported upon by the Massachusetts Bureau of Labour Statistics, only 18 were successful, 109 unsuccessful, 16 compromised, and 6 partially successful. The report of the Pennsylvania Bureau on 135 strikes showed 45 successful, 66 unsuccessful, 13 compromised, and 11 partially successful. The census report gives the results of 481 strikes, of which 169 were successful, 227 unsuccessful, and 85 compromised. This report shows also that the workmen are more successful in strikes growing out of demands for advances than they are in resisting demands for reductions. With the exception of the census report on strikes, these statistics cover a series of years, including periods of great depression in business as well as prosperous times, and may, therefore, be regarded as giving fairly average results.

Of the utter folly of many strikes there can be no question. They have been doomed to defeat from their inception. They have been undertaken in defiance of all economic laws, in ignorance of the condition of trade, and without any just cause. They have brought capital and decreased the wealth of the country. They have brought hunger, misery, debt; have broken up homes, severed long associations, forced trade to other localities, and driven men and women and little children into the very shadow of death, and yet men know that all of these possibilities are before them, will deliberately enter upon strikes, will cheerfully bear all these privations, and will more remarkable still, in many instances the wives of the strikers upon whom the misery falls with the most crushing force, will be most determined in their resolution. It would seem that there must be some reason for this, and I believe it will be found that strikes are not wholly wrong, and that even unsuccessful strikes are in many ways advantageous to the strikers. Labour has fought for every advantage it has gained, and though it is often defeated in its struggles that are called strikes, it has not only learned in these contests how better to wage future battles, but it has impressed employers with its strength that it has made them encounter antagonists constantly growing more formidable. The most hopeful indication of modern industrial society is the growth of mutual respect and goodwill between employers and employed, as well as a greater regard on the part of each for the rights of the other. To this result strikes have contributed in no small degree. They have also asserted the right of combined labour to deal with combined capital, and have denied the claim that the labour market was found in the "higgling" of capital with labour, and one individual workman with his weakness and necessities. In addition to this it will be found that many of the demands that have bid fair to improve the condition of labour, co-operation, industrial partnerships, boards of conciliation and arbitration, as well as wise rules and policy on the part of Trades Unions owe much to strikes.

WHEAL KITTY (ST. AGNES).—The next meeting is expected early in October, when the accounts for about 11 months are to be shown that the costs have been met by the returns of the year, which continue good no call has been made here since July, 1883.



**MINERAL RESOURCES OF NEW SOUTH WALES—No. II.**  
**MINERAL PRODUCTS.**—In Greville's Year Book for 1884 the value of the mineral products of the Australian colonies to the end of 1882 is set down at 345,000,000 sterling. In view of the fact that such a sum has been won from our Australian mines in little more than 30 years one cannot fail to recognise the vast mineral resources of these colonies, or the influence which the mining industry has exercised in bringing population to the shores, and in extending and facilitating the settlement of the interior. The further that New South Wales occupies the first place amongst those colonies in the production of the most useful minerals may be taken as evidence of the influence which the mining industry is exerting to exercise upon the future of this colony. Already the export of minerals from this colony has reached the value of 2,438,828, being the amount of our exports for 1883—the largest item being coal. Though there is a heavy decrease in our gold yield for 1883, there is a satisfactory increase in most of the other minerals, and a very considerable increase in some. The aggregate value of mineral products of 1883 is 3,204,901, being an increase upon that of 1882 of 422,557, 11s. 1d., and exceeds the decennial average by 351,111. The value of the output of minerals in 1883 exceeds that of any previous year, and the aggregate value of our mineral products to the end of 1883 is 61,064,764, 11s. 2d.

**GOLD.**—From the reports of the wardens and mining registrars it appears that the continued drought has had the effect of preventing prosecution of prospecting operations during the year, and has thus retarded the working of the older fields. Whether the falling off in the yield of gold can be accounted for by the absence of sufficient water to carry on the usual crushing and washing operations, or whether the decline is not in some degree due to the gradual exhaustion of such of the deposits in the older gold fields as are capable of being profitably worked without the aid of steam, hydraulic power, it is difficult to determine with any degree of certainty. It is quite certain that in the absence of new discoveries it is only a question of time, and that comparatively limited, before those deposits can be worked by the individual miner must be exhausted, with the breaking up of the drought we may reasonably expect that prospecting operations will be resumed and new ground opened. There is an unlimited extent of auriferous country within the older gold fields of this colony which, worked with proper appliances on a large scale, would yield satisfactory profits and give employment to a large body of miners for many years to come. But until the necessary capital and skill is brought to bear upon these deposits, or some new discoveries be made, we cannot expect to see any large increase upon our output.

Following the usual practice of adding the quantity of gold exported to that sent to the Mint for coinage as the nearest approach to the quantity of gold won during the year, the result would be the output of gold for the year would appear to be 154,587,488, valued at 582,575, but Mr. Hunt says that of the 31,261 ozs. 1 dwt. of gold exported in 1883—30,781 ozs. 17 dwts. had passed through the Mint, and is included in return of gold received for coinage, so that after making the necessary deduction the output of gold for 1883 would appear to be 123,805,58 ozs., valued at 458,508, 16s., or less by 671,707 ozs. in quantity, and 37,480, 19s. 3d. in value than the output of 1882. It is, however, to be noted that it is more probable that a large proportion of the gold won in the Albert district passes out of the colony without being included in either the Custom House returns, and the same may be the case in a degree in regard to some other gold fields near the borders. The number of miners engaged in gold mining during the year, according to the returns furnished by the mining registrars, is 6750. Of these 6742 are Europeans, and 1008 are Chinese. Comparing these numbers with those given in the report for 1882, we find a total decrease of 2465 miners, being a decrease of 2101 in the number of Europeans, and a decrease of 364 in the number of Chinese. This decrease appears to be mainly due to the severe drought. Taking as former years the output of gold divided by the number of miners indicating the average earnings of the miners, we find that each miner earned 18/34 ozs. of gold, valued at 671. 18s. 6/3d., for the year. Taking into consideration that mining operations were retarded more or less by drought in all the districts during some part of the year, the foregoing figures compare very favourably with the results as to the earnings of miners in 1882.

It is gratifying to find that efforts of a more practical nature than hitherto are now being made to solve the problem how to extract gold from pyritous matters by some processes which combine economy, efficiency, and moderate cost. Whether any of the processes at present before the public satisfy all these conditions it is impossible yet to say, but the tests made justify the hope that they will lead to the extraction of a larger proportion of the gold at a much reduced cost. At the present time the Watson's Reef Company is treating pyrites at Murrumbidgee, for which purpose they employ extensive machinery, and are said to obtain satisfactory results. Machinery has also been erected on the Sebastopol Reef for the purpose of treating pyrites on a large scale. I have not been able to ascertain the process employed at either of those places, but understand that at the latter place some kind of chlorination process will be used. Whether it is similar to that used at Sandhurst, a description of which I published some time since, I cannot say. It is proposed to introduce the necessary apparatus for working the Koch and Huntington process, which appears to be a recently introduced improvement by Prof. Huntington, of the London University, in a process used in Victoria some years since at some of our mines; and I understand a company has been, or is about being, formed to work the process patented by Mrs. E. B. Parnell, which, according to the description given, appears to be rather an improvement upon, or perfecting of, the old roasting and amalgamation process than a new process; the improvement consisting in the bringing together of the gold (which has been freed by washing from all impurities of soluble sulphates, &c.) and the mercury (which has been freed) in the conditions most favourable to their perfect amalgamation. Mr. W. A. Dixon, F.I.C., F.C.S., has tested the process on several samples of pyrites with a roughly devised apparatus, and obtained very satisfactory results. He says—"I believe that E. B. Parnell's process will actually separate gold from pyrites." Mr. J. C. Newbery has also tested the process with excellent results, and he says the process is simple and easily worked. Mrs. Parnell publishes a list of parcels of pyrites treated by her, varying from 1 lb. to 64 cwt., from which she extracted all the gold as shown by assay except a small quantity varying from 1 dwt. 4 grs. to 5 dwts. 1 gr. It is said that pyrites can be treated on a very large scale at a comparatively small cost by this process.

**COAL.**—Mr. C. S. Wilkinson, F.L.S., F.G.S. (the Geological Surveyor in charge), in his address as President of the Linnean Society, says—"The coal measures of New South Wales are estimated to occupy an area of about 23,950 square miles. There is reason to believe that the coal seams which are now worked in the northern, western, and southern coal fields underlie within a workable depth an area of 20,622 square miles" (nearly half the area of the coal fields of the United Kingdom of Great Britain). "It will be interesting to know how they contain, after deducting one half of the total contents of the seams for waste, &c., about 14,370,000,000 tons of coal, which at the present annual rate of production of about 2,500,000 tons would last for over 8000 years." As against the estimated quantity of coal in the concealed coal fields of Great Britain, Mr. Wilkinson's remarks may be quoted—"This estimate (referring to the 14,370,000,000 tons) does not include the other good seams within the same area not at present worked." And he adds, "When we consider that in the remaining area of the coal measures (20,622 square miles) coal seams are known to occur but have not yet been discovered, we may rest assured of the stability of this great source of national wealth." Coal is already the most important of our mineral products, not only in regard to its money value, but also as regards the number of persons employed in and about our collieries, and the value it gives to nearly all of our most important industries. In view of the foregoing facts it can scarcely be doubted that coal mining is destined to become the great industry of this colony, and that deposits should be spared. Already the diamond drills belong-

ing to the department have done good work in proving coal in various parts of our coal measures, as will be seen by the sections published herewith under the head of diamond drills, and this has been done without cost to the country. It was one of the points of importance laid down by the commission appointed by the Admiralty to investigate British coals for the purposes of the Navy, that coal should not progressively decay, which renders it liable to spontaneous combustion. Another condition laid down by the commission was that it should possess considerable cohesion of its particles, so that it may not be broken into too small fragments by the constant attrition which it may experience in the vessel. This is fulfilled in our northern coals, which are, with few exceptions, firm and not too easily crushed.

Our Newcastle coal is much denser than the English Newcastle, which it most resembles in properties. It is also higher than those of Derbyshire and Lancashire, whilst it is very little inferior in that respect to the coal of South Wales. The economic weight, or the space in cubic feet, occupied by 1 ton would thus be in its favour, as against all these English coals, by about 3 cubic ft., or 6 per cent., so that a steamer's bunkers would hold about 6 per cent. more coal than if she were supplied by English Newcastle. These numbers also give a gain in economic weight of about 5 per cent. in favour of our southern coals over those of South Wales. With regard to sulphur the results show that our coal contains on an average less than the coals of any of the celebrated coal fields of Great Britain. This is a point of very considerable importance, not only as lessening the risk of spontaneous combustion, but also allowing large quantities of coal to be burned without rendering the atmosphere impure. For the purpose of gas-making freedom from sulphur is a great advantage as the sulphur compounds formed during the process are difficult to remove. The quantity of ash in a coal is of some importance, as it represents so much useless matter which entails expense in removing, and if in large quantities impedes free combustion. In respect of ash the coals of our northern districts do not on an average stand so well as the English coal. The difference is, however, more than compensated for by the greater specific gravity, and consequently economic weight which enables a ship to carry more cargo.

The southern coals appear on the average to be not very much below those of South Wales in value. Of the latter some are very much better, some very much worse than the average, whilst there is not so much difference in those of the former. So far as stowage is concerned the increase of ash is to some extent, or perhaps entirely, compensated for by the increased specific gravity—that is to say, that a steamer which would carry 100 tons of average coal of South Wales in her bunkers could carry 105 tons of our southern coal, but the quantity of combustible matter would be the same, the additional 5 tons being ash. This does not afford an equivalent to the slightly increased stoking and the labour consequent on the removal of the ash, and the coal would necessarily be worth 5 per cent. less when delivered into the bunkers. Although the amount of volatile hydrocarbons in our southern coal averages about the same as that of the Welsh coal it is greater than that of those which are regarded as steam coals *par excellence*, and hence our coals would evolve more smoke and suffer from its attendant disadvantages.

In conclusion, the results point out that the coal from our northern coal field is practically equal for all purposes to the best English coal, on an average of both except that of South Wales, for the use of steamers has the advantage of giving a more perfect combustion with freedom from smoke. The remarks made with regard to resistance to weather action on the northern coals apply equally to those of the southern coast district. These coals differ from those of the northern coal field in having generally a duller appearance, higher specific gravity, more ash, and less volatile hydrocarbons—in which they approach more closely the Welsh seam coal. They are of the free burning, bituminous description.

The coals from the western district differ considerably from the others, and suffer much more from the action of the weather. They can be coked when fresh from the pit, but after exposure lose this property. These coals from their general character and properties are unlikely to be ever exported largely; but both these and numerous others not now worked, or worked in a small way only, are quite as well fitted for immediate local use as a great many coals worked in Great Britain, France, United States of America, and elsewhere, and specially suitable for smelting purposes.

The total output of our collieries for 1883 exceeded 2,500,000 tons, the exact figures—2,521,457 tons 1 cwt.—being 412,175 tons in excess of the output for 1882. The average price per ton in 1883 being 9s. 6/4d. as against 8s. 11/7d. per ton in 1882.

There has been considerable activity in the search for coal during the year, and there is reason to believe that several new collieries will be shortly opened up. A new coal company has been formed, and has started working a seam of coal between 4 and 5 miles from the Mittagong Railway Station, and one has been formed to work a coal seam about 3 miles from the Erith Colliery. The seam is said to be 7 or 8 ft. thick, and a seam of coal 5 ft. thick has been struck by boring about 1 mile south of the Erith Colliery. The Berrima Coal Company, while working the upper seam, is boring for another seam of coal some 60 or 70 ft. deeper. A seam of coal is reported to have been discovered at Bangawalyb, about 25 miles from Lismore, but nothing has been done on it yet. A seam of coal 2 ft. thick, containing 15 ins. of good, bright, clean coal, was passed through at Grattan at a depth of 183 ft. while boring for water. Coal of the best quality and in very large quantities is said to exist in the Coolah Valley.

**TIN.** The export of fine tin in 1883 exceeds that of any previous year since the tin fields opened, but the export of tin ore is less than any previous year, which is an important fact as evidencing the progress made in smelting tin ore. Taking ingots and ore together the export as regards quantity exceeds that of any previous year, but owing to the fall in the price of tin the value of the export for 1883 is less by 8909, than that of 1882. The low price of tin added to the scarcity of water and the great heat during the latter part of the year has had a depressing effect upon the tin industry on all the fields, but the recent examination of the Vegetable Creek tin field by Mr. Geological-Surveyor David shows that the tin deposits there are so extensive that there is little probability of exhaustion for many years to come. And there can be little doubt that a similar examination of our other large tin fields will prove equally satisfactory. Mr. Wilkinson in his report says the shallow stream tin deposits which have hitherto yielded such large supplies of ore are being rapidly exhausted, as are also the dry portions of the deep leads. The main lead was very rich in places, especially in the Wesley Mine and in that of the Vegetable Creek Tin Mining Company. In the latter 2000 tons of ore are stated to have been obtained within an area of 5 acres. The lead trends westerly from the Wesley Mine; the ground deepens and becomes wet, and therefore more difficult to work, but the prospecting shafts sunk into the wet drift show that it is rich in tin ore. The flow of basalt which covers the old river bed, and the other geological formations mark the continuation of the lead for several miles further. This fact shows that stream tin mining will last for many years to come. Upwards of 50 tin-bearing veins or lodes have been opened in this district, and though the majority of them are too small to be profitably worked, yet the Ottery, Carr's, Dutchman's, Curnow's, Butler's, Pheasant Creek, and several other lodes are of a promising character. The occurrence of the ore in the lodes is very variable; sometimes it is found in quartz, at others in felspar, greisen, chlorite, &c., and irregularly distributed through these as bunches, veins, or as disseminated grains. This uncertainty in its mode of occurrence will probably necessitate appliances specially adapted for the treatment of some of the kinds of ore. A well-arranged crushing plant with concentrators has been erected at the Tent Hill Smelting-works under the management of Mr. John Reid.

The Cope's Creek tin field, in the Inverell district, has also been examined by Mr. Wilkinson and Mr. David. Here, likewise, the shallow alluvial deposits are being fast worked out chiefly by Chinese miners. Several of the leads, notably Jones', Hammond's, Stannifer, Walmsley's, Brickwood, McMillan's, Jealousy, Elsmore, have been rich, and some of them are still being worked; but the tin ore has been found patchy in them, doubtless owing to the proximity of lodes from which the ore has been derived. Nearly all of the leads

have a covering of basalt, and the geological examination of the country shows that the basalt tracts extend to the westward from the Stannifer and Elsmore districts towards Auburn Vale and Inverell. It is reasonable, therefore, to infer from the nature of the leads already worked that where the bed rock formation consists of tin-bearing granites the old river beds or leads will in such places prove payable. Several attempts have been made to test these deep lead extensions, but chiefly owing to the hard sinking through the basalt rock and the heavy influx of water they have not been successful. These, however, are difficulties not insuperable.

The tin lodes, of which 15 have been prospected, occur much in the same manner as do those of the Vegetable Creek district. They are chiefly narrow quartz and felspar veins containing tin ore irregularly distributed through them; but at Elsmore, Long Gully, and Stannifer-Bischoff the lode stuff is met with in some quantity. At Elsmore it occurs in quartz veins and in irregular patches of mica rock, somewhat similar to those of the Ding Dong and Pheasant Creek mines; at Long Gully it is contained in quartz and felspar veins, and at Stannifer-Bischoff it is disseminated in separate coarse grains or crystals through porphyritic granite. Crushing machinery is now in course of erection at this mine. The warden reports a falling off in the output of the Maryland Mines due to want of and low price of tin towards the end of the year. No lodes are being worked in that district. In the Vegetable Creek district some few of the numerous lodes have been tested, and the warden states that 100 tons 18 cwt. 2 qrs. tin have been obtained from the crushing of lode stuff, of this 56 tons is from the Torrington Mine at the Mole Tableland. At the Ottery lode, near Tent Hill, there were 2000 tons of stone at grass awaiting completion of the battery. Only 6 tons of ore have been obtained from King's Tin Mine, Pheasant Creek, the men employed there having been chiefly engaged on surface works. There are indications that our lodes will speedily be worked if the price of tin would improve. The result of the new rush in the Tingha (parish of Aconite) is not yet known, as most of the land has been taken up under conditional purchase, and no work has been done beyond raising a few tons of ore which is equal in quality to any on the field. The warden reports that the bad state of the roads in the Tingha district adds very much to the cost of carriage of ore, and thereby retards the progress of mining.

**MINING IN DERBYSHIRE UNDER THE DERBYSHIRE MINING CUSTOMS AND MINERAL COURTS ACT OF 1852.—No. II.**  
BY W. NINES, M.E.

Derbyshire does not boast of trading with the Phœnicians, but evidences of the great antiquity of mining in the county are frequently met with. One of the oldest mines is that of the Old Nester at Matlock, on the heights of Abraham. It is now called the Rutland Cavern, and by anyone staying in the neighbourhood is worthy of a visit. This mine was successfully worked by the Romans, Saxons, and Danes, as well as in later times. Remains of the working of various lead mines in Derbyshire by the Romans still exist, and pigs of lead bearing inscriptions have been found in the county, one of these having the words—IMP. CAES. HADRIANI. AVG. MET. LVT.; another—L. ARVCONI. VERECVND. METAL. LVTVD.; and a third—TI. CL. TR. LVT. BR. EX. ARG. Undoubtedly the customs and privileges of the Derbyshire miners formed part of the customary laws of the Derbyshire mining district, for research has failed to show that they had an origin in writing, and it is admitted that from the earliest historic period the miners in this country have continued in the uninterrupted exercise and enjoyment of the various mining privileges. Yet they were ill defined and frequently led to disputes. Attempts were at various times made by the landowners to stop miners trespassing on their private lands, and the strong resistance of the former led the miners in the 16th year of the reign of Edward I. (1287) to petition the king to redress their grievances. He accordingly issued a warrant or commission directed to the Sheriff of Derbyshire signifying that the king had assigned Reginald of the Ley and William of Meymill to enquire by the oaths of good and lawful men of the county, concerning the liberties which the miners claimed to have in these parts. This commission was solemnly executed at Esseburn (Ashbourne) by a jury, who, by their inquiry, returned that the miners claimed, by no charter, but by immemorial custom, and that, by due observation of that custom, their rights and titles to those mines should be preserved to them. On that return the king admitted their laws and rights, and they have quietly enjoyed their privileges ever since. For some years, however, previously to the 15 and 16 Vic. c. clxiii. the mining laws and customs themselves, through neglect and desuetude, became uncertain and undefined; hence the passing of the Act as therein stated in the introductory remarks—"Whereas it is advisable that the said mineral laws and customs should be revised, altered, and amended, and that the jurisdiction of the said great and small barmote courts should be more clearly defined and settled," as they were in many respects inapplicable to the present mining operations in the King's Field within the said soke and wapentake of Wirksworth, and the said manors and liberties respectively." To undertake such a work as this on the part of the Legislature was an arduous task, and it is not to be wondered at that it contains articles which do not satisfy the aspirations of some parties. There are a certain class of people in existence, and I fear their name is legion, who, like the old man who always enjoyed the best of health took some physic to make him better and died from its effects. In this case, as in all others, there is nothing like letting well alone. For my own part, and I am speaking of an experience extending over a period of many years, in which I have mined within the jurisdiction of the Act, I desire nothing better than its provisions. By way of fully explaining the Act in its application it will be well to give some of its articles in a condensed form, and the following words and expressions which will be often applied hereafter have the meanings opposite assigned to them:—

Steward—Includes deputy steward.  
Barmaster—Includes deputy barmaster.  
County Court—Any county court in the county of Derby.  
Gift—The setting out of any ground in manner provided by the Act.  
Founder—The point at which a vein shall be at first found.  
Founder Meers—The first two meers to be set out to the finder under the provisions of the Act.  
Mine or Mines, Vein or Veins—A mine or mines, vein or veins of lead ore, and include parts of or shares in any mine or vein, as well as entire mines or veins, and all minerals containing lead ore.  
Ore—Lead ore exclusively.  
Mineral Property—Includes mines and veins of lead, parts in or shares in any such mines or veins, the works, rights, and appurtenances connected therewith, also lead ore, all tools, materials, goods, chattels, effects used in searching for, getting, cleansing, or preparing lead ore, whether such tools, materials, goods, chattels, or effects be found upon any mine or works, or elsewhere.  
ERRATUM.—Article No. 1, in the 45th line, calk is sulphate of barytes, or heavy spar.

**KINGSWOOD COLLIERS, AND THE BISHOP OF BRISTOL.**—Referring to Mr. Gladstone's subscription of 50l. to the endowment fund for the restored see of Bristol, and to his appreciative remarks with regard to Bishop Butler, whose episcopal career was chiefly connected with Bristol, the Ven. Archdeacon Norris (Aug. 12) writes:—"I am not without hope that not a few will rejoice to follow Mr. Gladstone's example in making the passing of the Bristol Bishopric Act an occasion for 'rendering a tribute, however small, of gratitude and admiration to the illustrious memory' of one whom Mr. Gladstone describes as 'the greatest and most profound writer among the divines and prelates of the Church of England.' Bishop Butler presided over the ancient see of Bristol from 1738 to 1750, and lies buried under the throne of our Cathedral Church. His last act on his death bed was to complete his gift of a site of a church for the colliers of Kingswood Chase, near this city; 20,000l. has been subscribed, 50,000l. more is needed, in gifts or bequests for the endowment of the see. Subscriptions or promises will be gladly received by myself or my co-secretary, Capt. Strachan Bridges. 'Bristol' is a sufficient postal address for either."



## ASSOCIATION FOR THE DEFENCE OF BRITISH INDUSTRY.

A number of gentlemen, chiefly resident in Wandsworth and Putney, have formed themselves into an association under the above title, and have issued a circular in which they express their desire to call attention to the general and continued depression in the trade of this country, and explain what they believe to be the chief causes of such depression. They say—"The extensive free importation of manufactured goods, which lessens the demand for British manufactures, overstocks the home market, causes a permanent fall in prices, prevents the British workman obtaining constant employment, and renders it impossible for the manufacturer to realise remunerative profits. Being fully convinced that there is an urgent necessity for the working classes to insist upon the adoption of a different commercial policy, we, therefore, propose—

"First. That the internal taxation of the United Kingdom, and the importation of all foreign products, shall be regulated in such a manner as to place our working population and our productive enterprise in a position as advantageous as that of any foreign competitor, and that this object shall be accomplished, either by the imposition of an import duty on foreign manufactures, or by the relief from taxation of the British industries affected (whichever may seem best to the Parliament of the United Kingdom).

"Secondly. That so far as can be judiciously carried out, the efforts of the Association shall be directed towards obtaining a much nearer approach to free exchange than now exists between the Mother Country and her Colonial dependencies.

"In the conviction that these objects are necessary and practicable, we ask your co-operation to induce Government to grant a Royal Commission of Enquiry into the working of the present system—a Commission upon which both the agricultural and manufacturing interests shall be well represented; in which not only the interests of the upper and middle, but also of the working classes shall be well considered; for, in this way, and this way only, shall we ever get to know the vast amount of injury we are suffering by the present fiscal policy of this country; and in this way, and in this way only, shall we ever obtain a practical remedy."

The replies to these assertions are that the free importation of foreign manufactured goods is an advantage to the community generally, and to the working classes in particular, since it enables them to supply their wants and obtain their luxuries at a lower price than would otherwise be possible. To tax foreign manufactured products would give the British workman less employment, because he would require more wages to secure him the same amount of necessities and luxuries as at present, and would thus prevent his employer from competing with the foreign manufacturer in foreign markets, and the English manufacturers would have to be closed. The present commercial policy, which is equally followed by Liberals and Conservatives, is a necessity so long as the same article can be produced more cheaply abroad than in Great Britain, or unless we have the raw material required to produce it in greater abundance or cheaper than our competitors. The attempt to return to the system of Protection would reduce the capitalists and manufacturer to poverty, and the working classes to starvation.

The secret of the ability of the foreigner to compete with Great Britain lies in the question of labour, and although it may seem to be an anomaly every general rise in the wages paid to workmen tends to deprive them of the means of living by sending the work elsewhere. In many of our trades they receive much more for a given quantity of work than they did 20 years since, but the amount of cash received per man per annum is less, because the shops are open fewer days in the year. Ask working engineers, carpenters, bricklayers, or others, whether this is or is not the case? And if these workmen live as well or better than they did 20 years ago it is due to the fact that they are supplied with foreign manufactured products at a low price. Thus the British workman may live equally well though he works much less, but for this advantage he is indebted to the fact that in other countries the working classes work much harder than he for much less money. If 10 hours be taken as the average day's labour of the British workman, the average day's labour of the French, German, and Dutch workmen will be between 16 and 17, and the shopkeepers work equally long hours; yet neither workmen nor shopkeepers receive an amount per head per annum at all approaching that received by corresponding classes in this country. Their cost of living, moreover, taken on the basis of the price of each commodity, would be greater than in Great Britain, but they live more frugally, and spend vastly less upon intoxicants, and thus secure material advantages which enable them to hold a better position. The Association for the Defence of British Industry seeks funds for holding meetings and otherwise educating the masses; to this there can be no objection if, though this seems scarcely probable, the education given by the Association be based upon truths and not upon fallacies.

## ELECTRIC BLASTING AND LIGHTING AT LLANWDDYN QUARRIES—No. II.

The electric fuses employed are what are known as Abel's high tension fuses, and consist of two gutta-percha-covered iron wires, 3 ft. long, twisted together. One end is enclosed in a small wooden cap, and in this the pointed ends of the wires are brought close together, leaving a space of about 1-32 in. between them, which is filled with a fulminating mixture. On a current being sent through it leaps as a spark across the space and ignites the fulminate, which in turn explodes a detonator, and through it the powder in the hole. Ordinarily the fuses are supplied with but a few inches of insulated wire, and it is necessary to attach a further length to this, thus making two joints which would be buried and out of sight in the hole. This was found to be a fruitful source of failure, so the fuses were provided with wires a yard long, being a sufficient length to reach down to the powder in the holes and also to stretch across half-way between two neighbouring holes. In order to protect the joints—where the insulating material was of necessity removed—from coming into contact with the rock, and thus short-circuiting the current and making a misfire, a short piece of fine indiarubber tubing is slipped over them and tied with string. This is an effectual remedy. The firing of so many holes simultaneously is a very grand sight, and if, as it rarely happens, it is necessary to do so at night time, the effect is very impressive. We were once present at one of these, but our description can give but a faint idea of the scene. The quarry was in full work under the pale, cold glare of the electric light, and was musical with the merry tinkling sound, like that of a dulcimer, of many hammers striking the resounding steel tools of quarrymen and stone-dressers; cranes rattling, locomotives hurrying about, foremen giving orders, and all the quarry filled with the busy sounds of working life. A bugle sounds out of a shadowy corner, and immediately the whole scene changes. The tread of hurrying feet takes the place of the tinkling music of the drills. The forms of many men dart across the brilliant path of light, and disappear in the gloom beyond. One by one lamps are lowered from their high masts and buried in their protecting boxes, and, with the lowering of the last, the quarry is shrouded in darkness and silence. A last warning blast from the bugle, and a voice from out the darkness crying, "All clear!" A few seconds more of silent suspense, and 30 jets of fire with dazzling flash illumine for a moment the whole quarry, showing up all its details as if by lightning. Mightystones are seen by its glare as they are hurled through the startled space, and falling, "mid the roar and shake as of an earthquake, dash to fragments as they reach the earth again. The heavier rocks descend the steep slopes in an avalanche carrying all before its irresistible might; and were it not for the heap of rubbish left to receive it, it would destroy the railroad at the foot and do damage in the quarry. Presently the lamps are again raised, the men resume their work, and the quarry is filled with the hum of life. The masons pick out the fresh stones most suitable, and commence to dress them. Cranes are busy loading, and before long the rock will be hurried away from its resting-place of many ages, and united again in a firm, compact mass, become the servant of man, and form the brim of a cup, from whence the thirsty thousands of a far-off city may drink and be satisfied.

In the summer of 1883, the question arose as to whether in the ensuing winter the quarry should be lit up with the electric light. As

the works for the foundation of the dam had been so illuminated during the previous winter, the various machinery was on the spot, but opinion differed as to the advisability of removing the machinery to the quarry or of leaving it in its original position and conducting the current by an overhead line of wires to the lamps at the quarry a mile away. This latter method was the one adopted.

The dynamos available were four 3000-candle power Siemens' direct wound machines and a separate exciter, which, however, was not used, the dynamos being coupled in series and made self-exciting. Their speed is 750 revolutions per minute. The conducting wires are carried at the summits of poles 30 ft. high and 80 yards apart. They are fastened to large white insulating mugs, one at each end of a cross-piece near the top of the pole. The wire itself is composed of a strand of five No. 16 copper wires, and has a resistance of about five ohms for the whole length. The area of the quarry was divided into as nearly as possible three equal portions, and in each of these a mast 80 ft. high was erected, from which the lamp is swung at any height found most convenient. The lamps are of Siemens' make, and are what are known as the Hefner von Alteneck differential lamp. Each lamp is supplied with two pairs of carbons, which burn alternately for about 14 hours, when they require to be renewed. Their peculiar construction allows of a number being coupled in series on the same circuit. In a small office which is devoted to the storing of the electric appliances are found the switches and resistance coil, of which there are three, one to take the place of each lamp in case of its failure during the night. A resistance frame resembles nothing so much as a spring mattress. It is made of rows of iron bands bent in flat springs, and contained in a wooden frame. Each frame offers a resistance equal to that of a lamp or five ohms. Dangerous heating of the coils of the dynamos and sparking at the brushes are avoided by inserting one of these resistances into the circuit in place of a lamp which may have failed to work. The four dynamos are required to work the three lamps, as the current from one is for the most part absorbed in overcoming the resistance of the long leads. The first evening that the lamps were used darkness had set in before all the arrangements were complete, and a crowd of workmen had gathered round the lamp at the bottom of the pole, commenting in Welsh possibly upon the absurdity of expecting a light from the two black sticks in the lamp. Suddenly the arc struck up, and the crowd, covering their eyes with their hands, retreated hastily from the dazzling globe of light. On another occasion, a lamp having gone out in the middle of the night, one of the men, of a more brilliant genius than the others, endeavoured to relight it with matches, but in vain; the number of burnt matches on the ground next morning testified to the fact, and showed the perseverance.

The quarry is as yet the only one in Wales which is illuminated by electricity, but a grand scope for its application is available in the immense slate quarries of the Principality, both in those on the surface and also in the vast chambers of an underground quarry in the Festiniog and other districts. If the state of the slate trade were sufficiently brisk, it would be worth while to fit up the slate-dressing sheds or machine houses with the electric light. These sheds are peculiarly adapted for the purpose; many of them cover areas of from 3000 to 6000 square feet under one roof, and they have motive power already at hand.

Works which are familiar to us await but the revival in the slate and lead trades before adopting the electric light at their dressing sheds and floors, and there is no doubt that its general introduction into the Principality, where water-power is so plentiful, is but a matter of time.

## FRANCKE "TINA," OR VAT PROCESS FOR THE AMALGAMATION OF SILVER ORES.

BY EDGAR P. RATHBONE, OF LONDON.

This process for the treatment of silver ores is the invention of Mr. FRANCKE, a German, long resident in Bolivia. In the treatment of rich but refractory silver ores, the inventor has successfully introduced this process, which has, by its satisfactory working, entirely eclipsed all other plans hitherto tried in Bolivia, Peru, and Chili. The Francke "tina" process is based on the same metallurgical principles as the system described by Alonzo Barba, in 1640, and also on those introduced into the United States in more recent times under the name of the Washoe process.

It was only after a long and careful study of these two processes, and other plans which had up to that time been tried with more or less success in Bolivia, Peru, and Chili—such as the Mexican "patio" process, the improved Freiberg barrel amalgamation process, as used at Copiapo, and the Kronke process—that Mr. Francke eventually succeeded in devising his new process, and by its means treating economically the rich but refractory silver ores, such as those found at the celebrated Huanchaca and Guadalupe Mines in Potosi, Bolivia. In this description of the process, the writer will endeavour to enter into every possible detail having a practical bearing on the final results; and with this view he commences with the actual separation of the ores at the mines.

The separation of the ore is effected by hand at the mines into different qualities by women and boys with small hammers, the process being that known as "cobbing" in Cornwall. The reason for this separation not being effected by those mechanical appliances so common in most ore dressing establishments, such as stone-breakers or crushing rolls, is simply because the ores are so rich in silver, and frequently of such a brittle nature that any undue pulverisation would certainly result in a great loss of silver, as a large amount would be carried away in the form of fine dust. So much attention is indeed required in this department that it is found requisite to institute strict superintendence in the sorting or cobbing sheds, in order to prevent as far as practicable any improper diminution of the ores. According to the above method the ores coming from the mine are classified into the four divisions:—

The first of these qualities—the very rich ore about 1 oz. to 1 lb.—is so valuable as to render advantageous its direct export in the raw state to the coast for shipment to Europe. The cost of fuel in Bolivia forms so considerable a charge in smelting operations that the cost of freight to Europe on very rich silver ores works out at a relatively insignificant figure when compared with the cost of smelting operations in that country. This rich ore is consequently selected very carefully, and packed up in tough raw hide bags, so as to make small compact parcels some 18 in. to 2 ft. long, and 8 to 12 in. thick, each containing about 1 cwt. Two of such bags form a mule load, slung across the animal's back.

The second and third qualities of ore—1 per cent. to 3 per cent. silver—are taken direct to the smelting works; and where these are situated at some distance from the mines, as at Huanchaca and Guadalupe, the transport is effected by means of strong, but lightly built, iron carts, specially constructed to meet the heavy wear and tear consequent upon the rough mountain roads. These two classes of ores are either treated separately, or mixed together in such proportion as is found by experience to be most suitable for the smelting process.

On its arrival at the reduction works the ore is taken direct to the stamp-mill. At the Huanchaca Works there are 65 heads of stamps, each head weighing about 500 lbs., with five heads in each battery, and crushing about 50 cwt. per head per 24 hours. The ore is stamped dry, without water, requiring no coffers; this is a decided advantage as regards first cost, owing to the great weight of the coffers, from 2 to 3 tons—a very heavy item when the cost of transport from Europe at about 50l. per ton is considered. As fast as the ore is stamped it is shovelled out by hand, and thrown upon inclined sieves of 40 holes per lineal inch; the stuff which will not pass through the mesh is returned to the stamps.

Dry stamping may be said to be almost a necessity in dealing with these rich silver ores, as with the employment of water there is a great loss of silver, owing to the finer particles being carried away in suspension, and thus getting mixed with the slimes, from which it is exceedingly difficult to recover them, especially in those remote regions where the cost of maintaining large ore-dressing establishments is very heavy. Dry stamping, however, presents many serious drawbacks, some of which could probably be eliminated if they received proper attention. For instance, the very fine dust,

which rises in a dense cloud during the operation of stamping, only settles down on all parts of the machinery, interfering with proper working, so that some part of the battery is nearly always stopped for repairs, but is also the cause of serious inconvenience to the workmen. At the Huanchaca Mines, owing to the presence of galena or sulphide of lead in the ore, this fine dust is of an injurious character as not unfrequently to cause the death of the workmen; as a precautionary measure they are accustomed to stuff cotton wool into their nostrils. This, however, is only a preventive, and the men find the best method of overcoming evil is to return to their homes at intervals of a few weeks, the places being taken by others for the same periods. In dry stamping there is also a considerable loss of silver in the fine particles of ore, which are carried away as dust, and irrevocably lost. To prevent this loss, the writer proposed whilst at Huanchaca that a chamber should be constructed, into which all the fine dust must be exhausted or blown by a powerful fan or ventilator.

From the stamps the stamped ore is taken in small ore-cans to the roasting-furnaces, which are double-bedded in design, one bed being built immediately above the other. This type of furnace is proved, after various trials, to be that best suited for the treatment of the Bolivian silver ores, and is stated to have been found the most economical as regards consumption of fuel, and to give the least trouble in labour. At the Huanchaca Mines these furnaces are about 100 ft. each, and are capable of roasting from 2 to 2½ tons of ore in 24 hours, the quantity and cost of the fuel consumed being Tola (a kind of shrub), 3 cwt., at 60 c., \$1.80; yareta (a resinous moss), 4 cwt., at 80 c., \$3.20; torba (turf), 10 cwt., at 40 c., total, \$9, or 28s. One man can attend to two furnaces, and cost 3s. per shift of 12 hours.

Probably no revolving mechanical furnace is suited to the roasting of these ores, as the operation requires to be carefully and intelligently watched; for it is essential to the success of the Francke process that the ores should not be completely, or "dead" roasted, inasmuch as certain salts prejudicial to the ultimate proper working of the process are liable to be formed if the roasting is too protracted. These salts are mainly due to the presence of antimony, zinc, lead, and arsenic, all of which are unfavourable to amalgamation. The ores are roasted with 8 per cent. of salt, 400 lbs. of salt for the charge of 2½ tons of ore; the salt costs 70 cwt. or 2s. 2d. per 100 per lbs. So roasted the ores are only partially chlorinised, and their complete chlorinisation is effected subsequently during the process of amalgamation; the chlorides are thus formed progressively as required; and, in fact, it would almost appear that the success of the process virtually consists in obviating the formation of injurious salts. All the sulphide ores in Bolivia contain sufficient copper to form the quantity of cuprous chloride requisite in the first stages of roasting, in order to render the silver contained in the ore thoroughly amenable to subsequent amalgamation.

From the furnaces the roasted ore is taken in ore-cans to large hoppers or bins situated immediately behind the grinding and amalgamating vats, locally known as "tinias," into which the ore runs from the bin through a shoot fitted with a regulating slide. The tinias, or amalgamating vats, constitute the prominent feature of the Francke process; they are large wooden vats, from 6 to 10 ft. in diameter and 5 ft. deep, capacious enough to treat about 2½ tons of ore at a time. Each vat is very strongly constructed, being bound with thick iron hoops. At the bottom it is fitted with copper plates about 3 in. thick, and at intervals round the sides of the vat are fine copper plates, with ribs on their inner faces, slightly inclined to the horizontal, for promoting a more thorough mixing. It is considered essential to the success of the process that the bottom plates should present a clear rubbing surface of at least 10 square feet.

Within the vat, and working on the top of the copper plates, there is a heavy copper stirrer or muller, caused to revolve by the shafting at the rate of 45 revolutions per minute. At Huanchaca this stirrer has been made with four projecting radial arms, but at Guadalupe it is composed of one single bell-shaped piece, without any arms, but with slabs like arms fixed on its underside; and the latter is claimed to be the most effective. The stirrer can be lifted or depressed in the vat at will by means of a worm and screw at the top of the driving shaft. The bevel gearing is revolved by shafting connected with pulley wheels and belting, the wheels being 3 ft. 1½ in. diameter, and 6 in. broad. The driving engine is placed at one end of the building. Each vat requires from 2½ to 3 horse power, or in other words an expenditure of one horse power per ton of ore treated. At the bottom of the vat and in front of it a large wooden stop-cock is fitted, through which the liquid amalgam is drawn off at the end of the process into another shallow bottomed and smaller vat. Directly above this last vat there is a water hose, supplied with a flexible spout, through which a strong stream of water is directed upon the amalgam as it issues from the grinding vat, in order to wash off all impurities.

In the mode of working usually employed the grinding vat or tinia is first charged to about one-fifth of its depth with water, and from 6 to 7 cwt. of common salt. The amount of salt required in the process depends naturally on the character of the ore to be treated, as ascertained by actual experiment, and averages from 150 to 300 lbs. per ton of ore. Into this brine a jet of steam is then directed, and the stirrer is set to work for about half-an-hour, until the liquid is in a thoroughly boiling condition, in which state it must be kept until the end of the process. As soon as the liquid reaches boiling point the stamped and roasted ore is run into the vat, and the end of another half-hour about 1 cwt. of mercury is added, the other quantities being added as required at different stages of the process. The stirring is kept up continuously for 8 to 12 hours, according to the character and richness of the ores. At the end of this time the amalgam is run out through the stop-cock at bottom of the vat, and put into hydraulic presses, by means of which the mercury is squeezed out, leaving behind a thick pulpy mass, composed mainly of silver, locally termed a "piña," from its resembling in shape the cone of a pine tree. These "piñas" are then carefully weighed and put into a subliming furnace, in order to drive off the rest of the mercury, the silver being subsequently run into bars. About 1 cwt. of mercury are lost for every pound of silver made.

The actual quantities of mercury to be added in the grinding vat, and the times of its addition, are based entirely on practical experience of the process. With ore assaying 150 to 175 oz. of silver to the ton, 75 lbs. of mercury are put in at the commencement, another 75 lbs. at intervals during the middle of the process, and, finally, another lot of 75 lbs. shortly before the termination. When treating "pacos" or earthy chlorides of silver, assaying only 20 to 30 oz. of silver to the ton, 30 lbs. of mercury is added to 2½ tons of ore at three different stages of the process, as just described. The rationale of the process therefore appears to be that the chlorination of the ores is only partially effected during the roasting, so as to prevent the formation of injurious salts, and is completed in the vats in which the chloride of copper is formed progressively as required, by the gradual grinding away of the copper by friction between the bottom copper plates and the stirrer, and this chloride subsequently becoming incorporated with the boiling brine is considered to quicken the action of the mercury upon the silver.

The subliming furnace is a plain cylindrical chamber, about 4 ft. diameter inside and 4½ ft. high, lined with fire-brick, in the centre of which is fixed the upright cast-iron cylinder or retort of 1 ft. diameter, closed at top and open at bottom. The furnace top is closed by a cast-iron lid, which is lifted off for charging the fuel. Round the top of the furnace is a tier of radial outlet holes for the fuel smoke to escape through; and round the bottom is a corresponding tier of inlet air-holes, through which the fuel is continually rabbled with poles by hand. The fuel used is lignum, costing 80 cwt. or 2s. 6d. per 250 lbs.; it makes a very excellent fuel for smelting purposes, smouldering and maintaining steadily the low heat required for subliming the mercury from the amalgam. Beneath the furnace is a vault containing a wire mesh iron water-tank, into which the open mouth of the retort projects downwards, and is submerged. For charging the retort the water tank is placed on a trolley, and standing upright on a stool inside the tank is placed the piña or conical mass of silver amalgam which is held together by being built up on a core-bar fitted with



of horizontal discs. The trolley is then run into the vault, the water-tank containing the pila is lifted by screw-jacks, so as to raise the pila into the retort, in which position the tank is supported by a cross-beam. The sublimed mercury is condensed and collected in the water, and on the completion of the process the tank is lowered, and the spongy or porous cone of mercury is withdrawn from the retort. The subliming furnaces are arranged in a row, and communicate by lines of rails with the weighing.

# NON-PHOSPHORETTED BRITISH IRON—No. III.

With respect to the Sandwick spathose ores above described, it must be borne in mind that the low yield of 40 per cent. in the retort is due to the presence of lime and magnesia. But as the earthy matters disperse *pro tanto* with the flux required in the blast, they are not contained in the iron, it will be found that the yield of the iron is proportionally higher. As in all other deposits of iron ore the beds differ in yield from each other, but when they have all been examined and classed it will be found that their average yield is in effect equal to that of any such ore in Europe. Analyses of copper ore from Sandwick Mine, South Shetland. 1 by Mr. Robert McAtteg, Chemist, Falkirk; No. 2 by Mr. John Patterson, Chemist, Newcastle:—

	No. 1 dried. Per cent.	No. 2 partially dried. Per cent.
Peroxide of iron .....	71.22	66.71
Peroxide of manganese .....	4.81	2.39
Oxide of copper .....	6.67	4.72
Alumina .....	2.66	0.40
Lime .....	0.65	0.45
Magnesia .....	0.27	0.34
Silica .....	13.17	9.20
Sulphur .....	trace	0.10
Phosphoric acid .....	0.37	0.71
Combined water .....	—	10.87
Moisture .....	—	4.00
	90.82	99.89

Metallic iron .....	94.85	46.70
Metallic copper .....	5.32	3.77

Analyses by Mr. McAtteg of a similar sampling taken along the vein in other places, and analysed as taken from vein:—Rawin Mine: 40 per cent. of copper, 4.10 per cent. = 5.27 per cent. of metallic copper; loss by calcining, 46.80. This ore when dried in a pulverised state.

The following analysis was made from a sampling of a 20 ton lot of copper ore found in the 11 fathom level among hematite, Mr. John Patterson, Newcastle:—Copper, 33.40 per cent.; iron, 27 per cent.; sulphur, 26.25 per cent.; arsenic, 0.30 per cent.; trace; magnesia, trace; carbonic acid, 0.52 per cent.; siliceous matter, 4.60 per cent.; moisture, 0.26 per cent.; oxygen and loss, 100.00.

Certificate of Analysis.—Samples of copper ore from Sandlodge Mine, Sandwick:—

Sample No. 1.	Sample No. 2.	
6,080	2,860	
6,477	7,985	
23,800	47,000	
23,839	6,650	
10,900	3,394	
11,972	32,379	
traces	traces	
16,900	—	

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and dressing the copper ore.—4. *Pari passu*, to open the hematite ore in the Sandwick Mine and the spathose ore in the South Devon Mine respectively, and to arrange for the way-leave from the latter to join the Teign Valley Railway by a tramway.—5. The hematite being sufficiently opened, and the tramway, the quay, and their accessories being completed to work the hematite for export, organising meanwhile an adequate supply of steam shipping for its conveyance to market.—6. As soon as the South Devon Mine is in a state to supply a sufficient quantity of spathose iron ore aided by that from Shetland to rent or hire one or more blast furnaces in South Wales conveniently situated as to carriage of ore for making spiegeleisen or ferro-manganese.

The returns from these various sources, the trade in hematite ore, the copper works, and the spiegeleisen, or ferro-manganese ought to suffice to allow of a dividend all round of from 10 to 15 per cent., taking 2s. 6d. as the least profit on the hematite per ton with an output of only 100 tons daily, the copper at the profit fixed by Messrs. Taylor, and that on the spiegeleisen at 2l. per ton on 250 tons weekly from one furnace. It will remain for consideration, dependent on the general state of the iron market or on the fair prospect of displacing ordinary iron, how soon the building of the furnaces at Middlesbrough should be commenced, bearing in mind, however, that if the interest of money is of secondary consideration, this interval of low prices for materials and labour should have its weight on our preference.

It might be advisable with a view to the sale of iron suitable to conversion into steel to erect not only furnaces but a mill and forge for working up the cast into bar iron. After trying the steel market with this iron, it might even be expedient to put up a forge and mill for drawing bar steel. The manufacture of armour plates and coil iron for guns, as well as ship plates, iron or steel, will be within the scope of the company's powers. The absence of sulphur and phosphorus in the ores clearly places all these methods of utilising them within the means of the company, so far as raw materials are concerned, the only question being how far the operations of the company could in commercial prudence be extended to them.

**SAFE USE OF STEAM.**—A well-considered and thoughtfully written little pamphlet—The Safe Use of Steam, containing rules for the guidance of unprofessional steam users. By an Engineer—issued by Messrs. Crosby Lockwood and Co., of Stationers' Hall-court, has just reached its fifth edition. It is scarcely necessary to repeat that it contains much really valuable information which users of steam will find it to their pecuniary advantage to possess.

**COPPER, SPELTER, AND LEAD.**—Messrs. HENRY ROGERS, SONS, and Co. (Aug. 7) write:—We have to record a heavy decrease in the total visible supplies of copper during July. The deliveries in England and France have been the largest ever known—10,817 tons; and, taking into account cable advices, stocks have fallen from 46,763 tons to 43,052 tons. Such an improvement in the statistics of the article have forced prices up in the face of dull times. The actual copper shipments from Chili during the month only totalled 1500 tons, although the charters were far heavier, and it is possible that the arrivals of American copper may temporarily fall off a little. It seems fairly certain that the total visible supply of the world cannot be permitted to go for any length of time much lower than it is at present; and though we may not yet fully realise the powers of both Spain and America to increase their production, even at present prices, it seems reasonable to hope with a good harvest, a fair autumn trade, and some temporary diminution in supplies, we may see a gradual hardening in value resulting from the necessity of protecting our available stocks. After such deliveries as we had in the month of July we cannot, however, be disappointed if the August consumption is apparently small. Spelter remains very dull at late prices, with rather a tendency in some quarters to sell for forward delivery. Consumers, however, who cover their wants for the next six months at this low range of value, act, as we think, wisely. In lead a sharp rise has taken place, and the price of soft Spanish without silver has advanced from 10l. 2s. 6d. to 10l. 17s. 6d. The immediate cause was the temporary disarrangement of shipments from Spain, owing to quarantine regulations; the movement, however, thus started has seemed to draw general attention to the unprecedentedly low values lately ruling, and more importance is attached to the reduction of supplies brought about by late low values.

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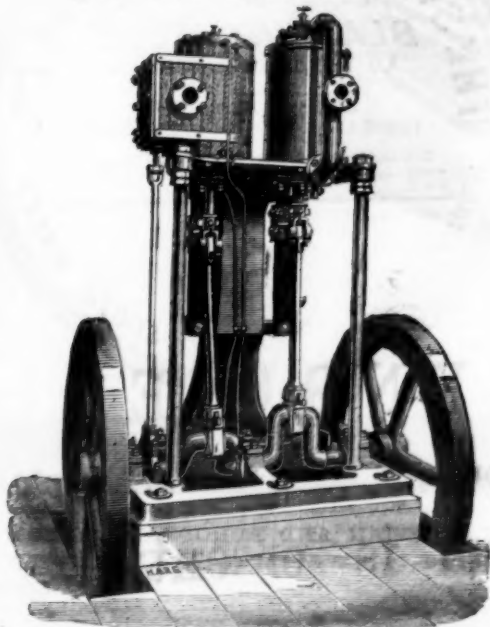
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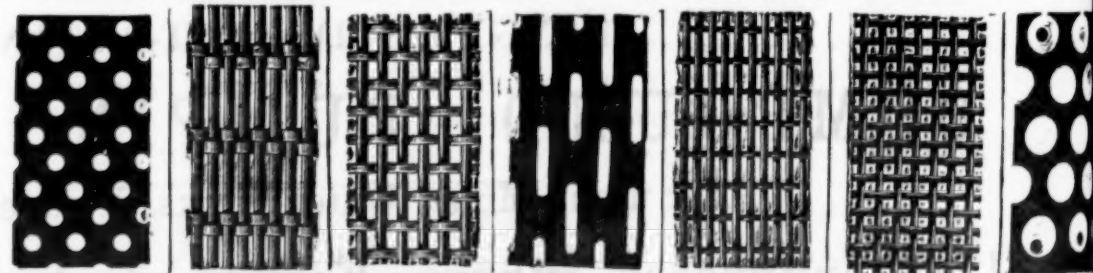
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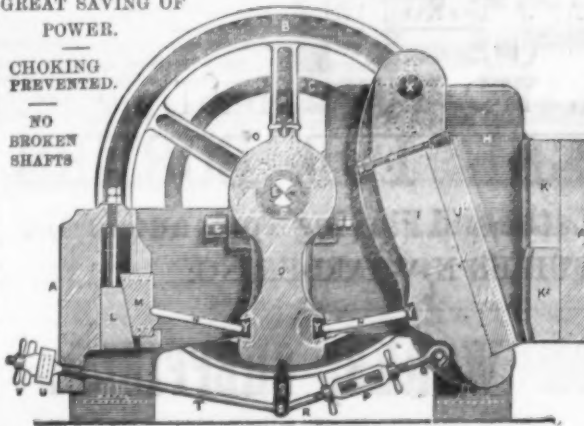
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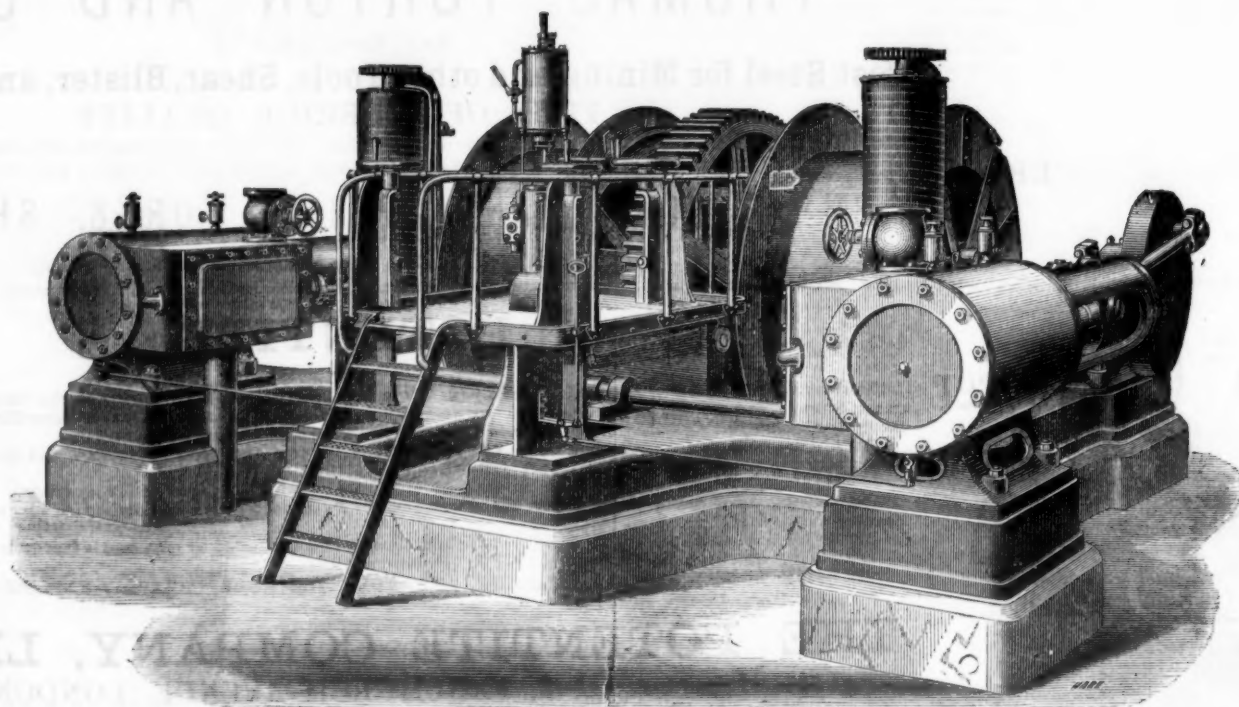
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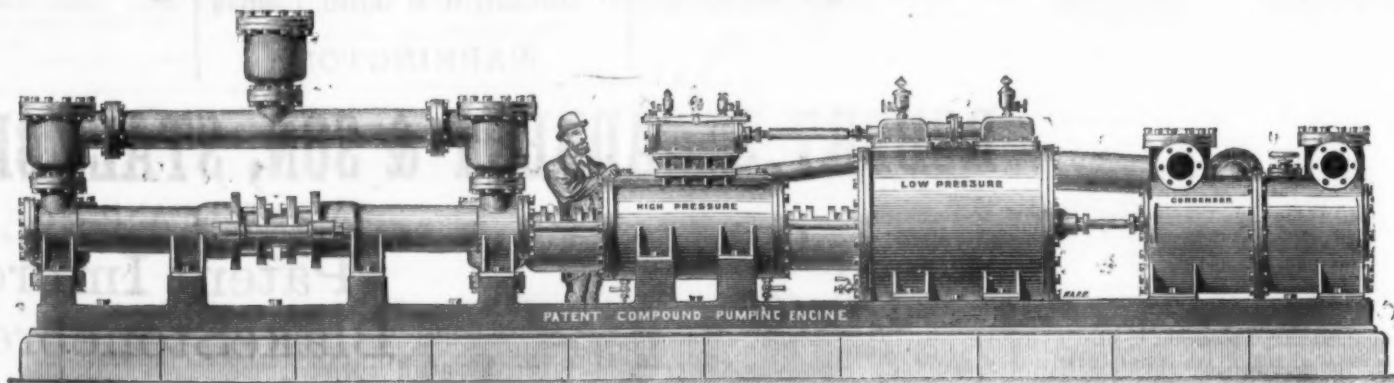
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"I have great pleasure in bearing testimony to the merits and capabilities of your patent combined fine crusher and sieving apparatus. I have tried it on a variety of ores and minerals, and it pulverizes them with equal success. You can put in a small paving stone and bring it out like flour."

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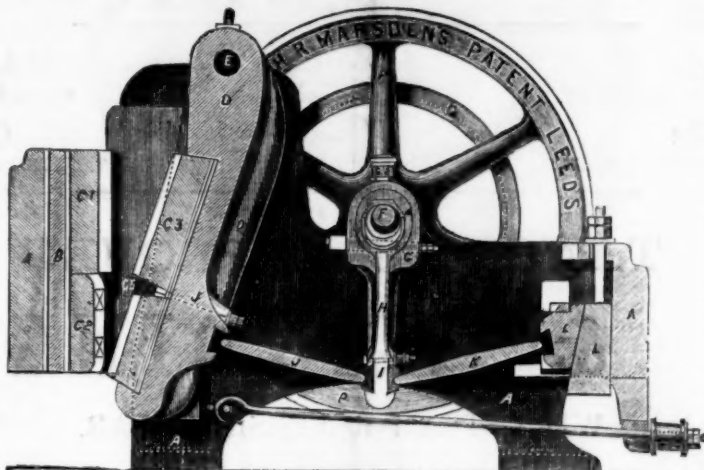
"I am sure the machine will be a success, and a great one, and there is any amount of demand for such a machine. We can work it with 20 lbs. of steam, and our engine, which is a 12-h.p., plays with the work, in fact we run the Stonebreaker and the Pulverizer both together with 35 lbs."

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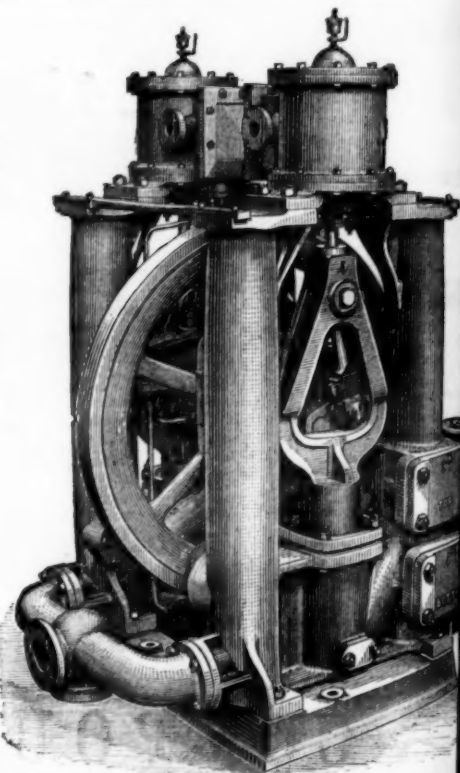
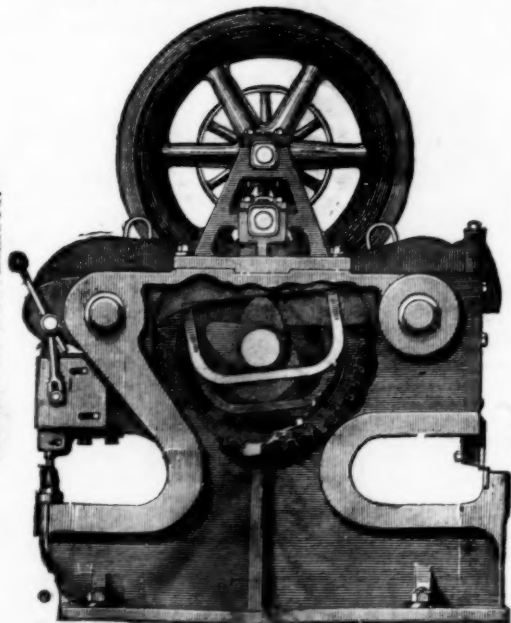
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